Dräger medical
A Dräger and Siemens Company

Oxylog 3000 Service Training Manual

CONTENTS:

1. Checking Readiness for Operation.
2. Schematics and Diagrams.
3. Repair Instructions.
4. Service Mode.
5. Fault – Cause – Remedy.
6. Error Lists.
7. Maintenance Information.
8. PMS – Oxylog 3000.

Note: This manual is not designed to be a complete service manual and should be used with both the Technical manual and Operators manual. The information contained within this document is confidential and not transferable. All information is the latest available at time of training.

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Description of Seminar Requirements

	Draeger Oxylog 3000 Transport Ventilator
Duration	1 Day
Target Group	Hospital Biomedical Technicians
Seminar goal	Participants should acquire the following knowledge in this seminar: • Operation of the equipment. • Design of the equipment. • Service mode in theory and practice. • Testing as per Safety & Function Test Certificate. • Ability to classify errors (operator errors, device faults). • Repairs to board/assembly level.
Contents	Oxylog 3000. • General layout and operation. • Ventilation mode operation. • Electronic block diagram discussion. • Electronic disassembly. • Pneumatic block diagram discussion. • Pneumatic disassembly. • Replacement parts discussion • Service mode operation. • Service mode in practice. • Error code list and explanation. • Troubleshooting. • Examination. • Testing based on SFT certificate. • Final discussion.
Items to be brought by participants.	• Writing material, pens.
Training room equipment required	• Overhead projector. • Whiteboard and markers. • Gas supplies (oxygen and air). • Training unit.
Training Material	• Latest documentation.
Test Equipment	• All necessary tools and test equipment provided by trainer.
Comments	• Participation in full course duration only. • Certificates provided at successful completion of course.

Section 1

Checking readiness for operation

– whenever the ventilator has been prepared or the ventilation hoses changed
– at the latest every six months.

The following functions are checked with the menu-based test:

– Gas supply present
– Hose system / breathing valve connected and OK
– Alarm functions OK
– Ventilation functions OK
– Monitor functions OK.

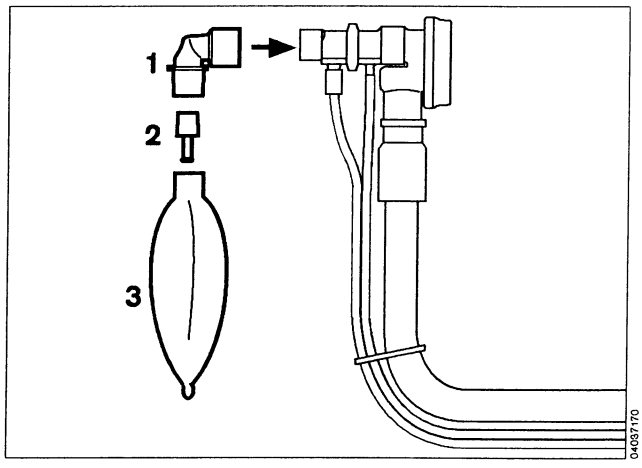
Oxylog 3000 interrupt the test if a fault is detected.
The relative fault is indicated on the screen.

The patient may be endangered if the above pre-use check is not carried out.

Connecting test lung

The test lung comprises:

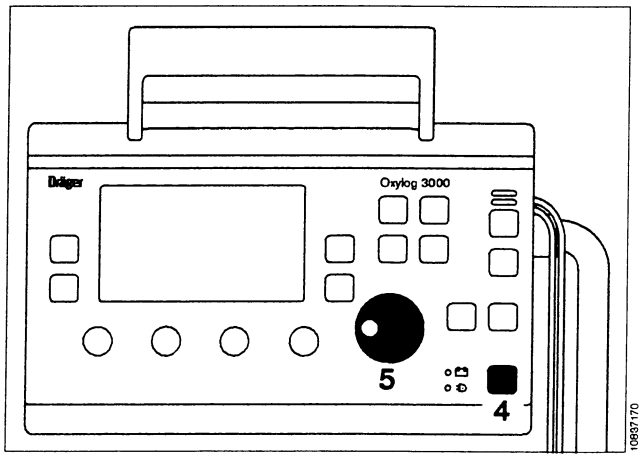
1 an angled connector for connection to the ventilation valve,
2 a catheter connector, diameter 7 mm, in the angled connector – to simulate the resistance of the airways.
3 2 L breathing bag 84 03 201 to simulate the lung compliance.



Perform device check

Duration: approx. 3 minutes.

4 Switch Oxylog 3000 on = press the »⏻« key. The device runs through a self-test and the operator is prompted, on the display, to call up the configuration menu or device check:
Press rotary knob for device check and configuration
5 Press rotary knob to confirm.



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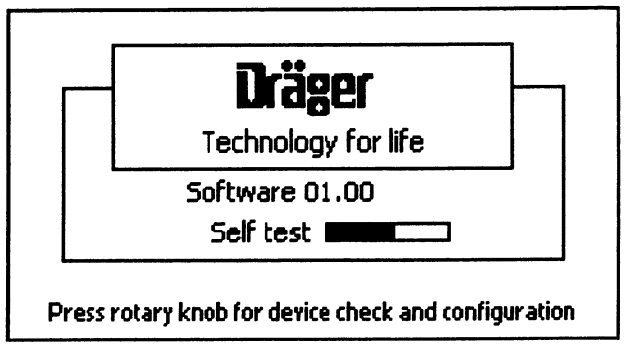
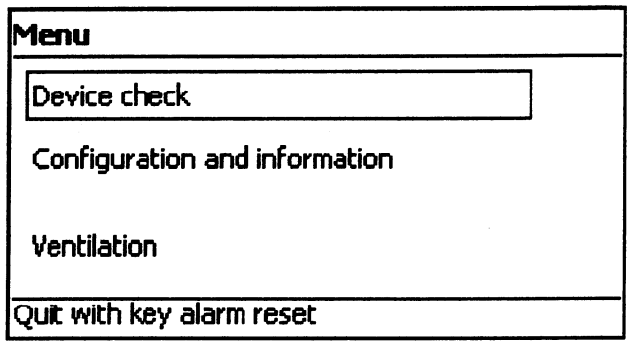
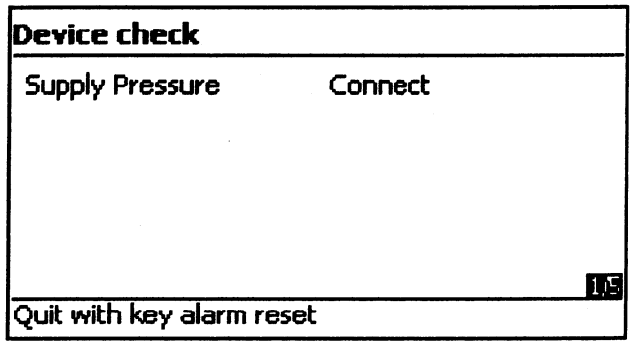


- Select »**Device check**« in main menu and confirm.

The device check can be ended at any time by pressing the »**Alarm Reset**« key.



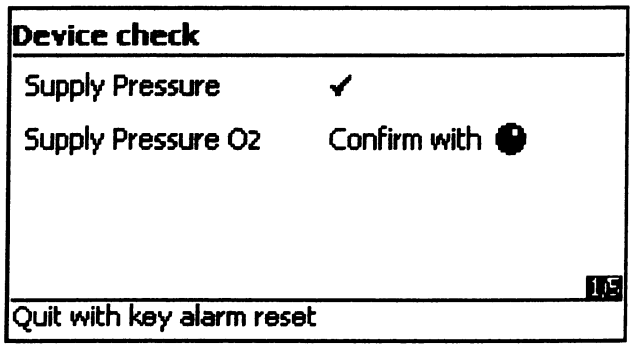
- Ensure that the gas supply has been connected.



- Ensure that the correct gas type (O_2 or medical air) has been set and confirm.

If the wrong gas type has inadvertently been set:

- Press »**Alarm Reset**« key to cancel device check.
- Set correct gas type in configuration "Select gas supply" and restart device check.



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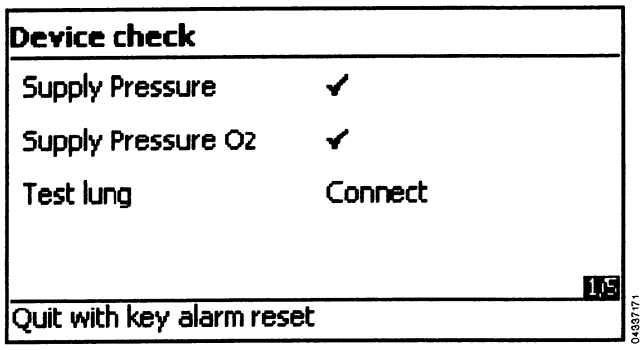
- Ensure that the test lung has been connected.



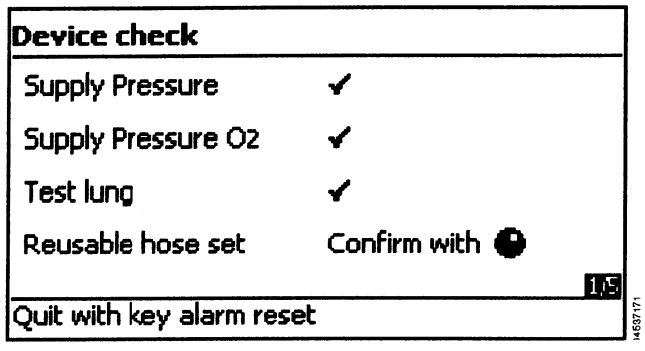
Oxylog 3000 automatically checks whether a test lung has been connected. The device check is aborted if a test lung is not detected within one minute.

The check is continued when Oxylog 3000 detects the test lung.

- Ensure that the configured hose system has been connected – either:

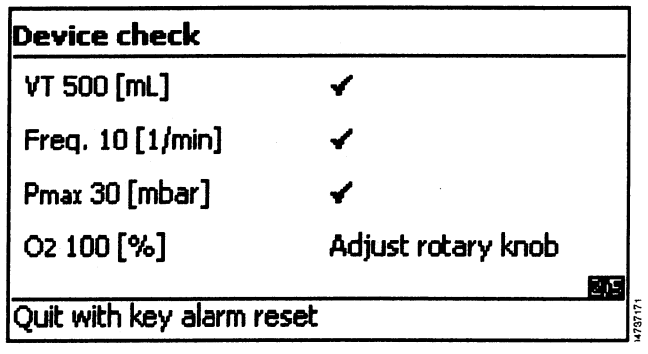
– the disposable hose set
or
– the reusable hose set
and confirm.

- Confirm the appropriate hose set and the second page of the device check appears.

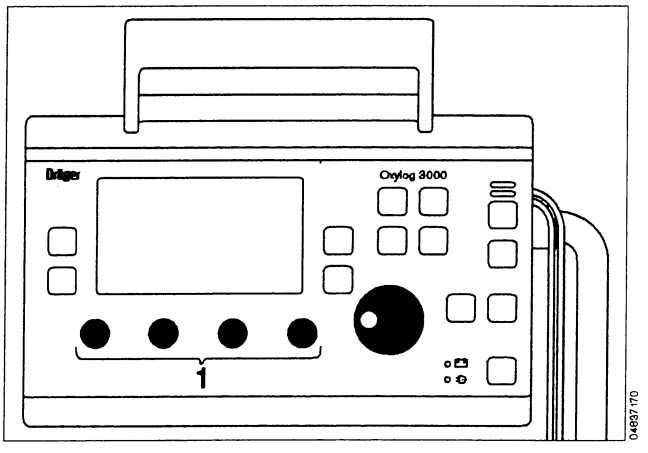


If the wrong hose set has inadvertently been configured:

- Press »**Alarm Reset**« key to cancel device check.
- Select correct hose set in "Customer Service Mode", "Select hose type", page 78, and
- restart device check.



1 Set the controls below the screen to the required values.



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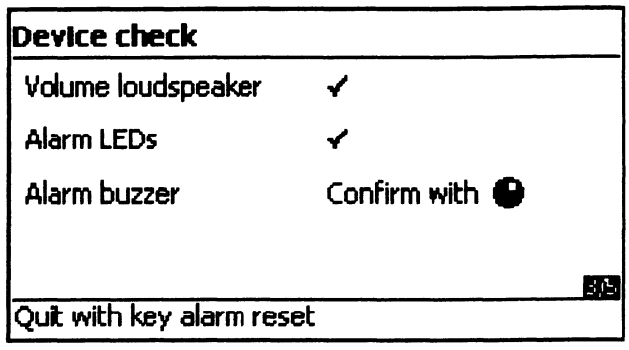
Oxylog 3000 successively activates the acoustic and visual alarm signals and prompts the operator to acknowledge each signal.

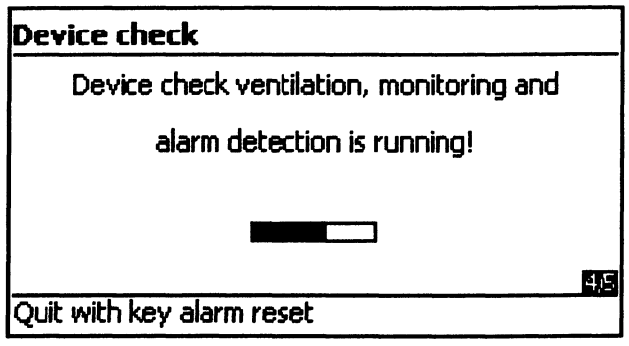


- Confirm acoustic and visual alarm signals.

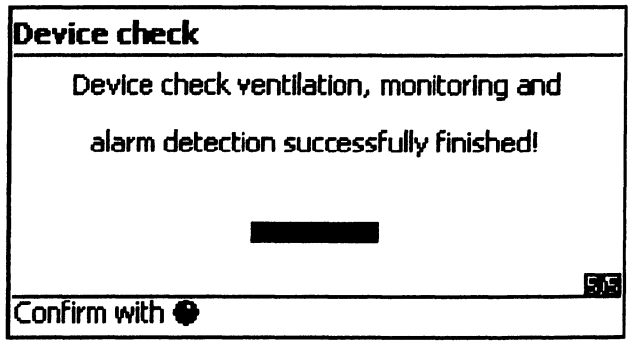
The device check proceeds automatically.

During the automatic test sequence, Oxylog 3000 checks the flow, pressure build-up and alarm signals. Corresponding sounds are heard.

The bar graph shows the progress made by the check.



The result is displayed by Oxylog 3000:



- Confirm, and the system switches back to the menu screen.

If the device check cannot be completed successfully:

- Consult the section "Error messages during device check", page 30.
- Check configuration, page 51 onwards.
- Consult the chapter "Fault – Cause – Remedy", page 53.
- Call DrägerService.

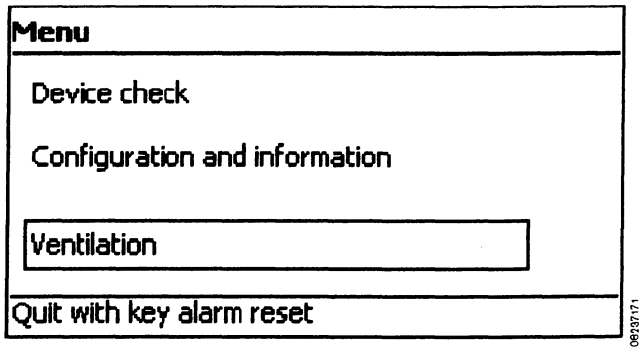
- Assemble the Oxylog 3000 ready for operation, page 16 onwards.
- Connect to power supply and gas supply, page 19 onwards.

Start the ventilator:

- Select »**Ventilation**« and confirm

or

- press »**Alarm Reset**« key.



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Error messages during device check

Message	Cause	Remedy
No communication control- / charge-board	Device defective.	Call DrägerService.
System leakage	Leak in ventilation hose and/or test lung.	Check hoses, breathing valve, flow sensor and test lung for leaks and replace if necessary.
	Internal leak in system.	Call DrägerService.
No testlung	Test lung not connected or major leakage.	Connect test lung. Check hoses, breathing valve, flow sensor and test lung for leaks and replace if necessary.
Breathing valve inop	Breathing valve has malfunctioned. Yellow diaphragm	Check correct condition of breathing valve including diaphragm and rubber disc; fit a new breathing valve if necessary or use a new disposable hose set.
Pressure measurement inop	The ventilation hose set has not been connected correctly.	Connect ventilation hose set correctly.
	Pressure measurement is implausible.	Call DrägerService.
PEEP valve inop	Internal leak in system.	Check hoses, breathing valve, flow sensor and test lung for leaks and replace if necessary.
	Device defective.	Call DrägerService.
Flow measurement inop	Flow measurement implausible.	Replace flow sensor. Call DrägerService.

if 100mbar blow-off valve not working

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Section 2

1 General introduction

This section presents the diagrams and overviews of the Oxylog 3000, such as the pneumatic components diagram and the block diagram of the electronics. In some cases the diagrams and overviews are also used as references to describe functions.

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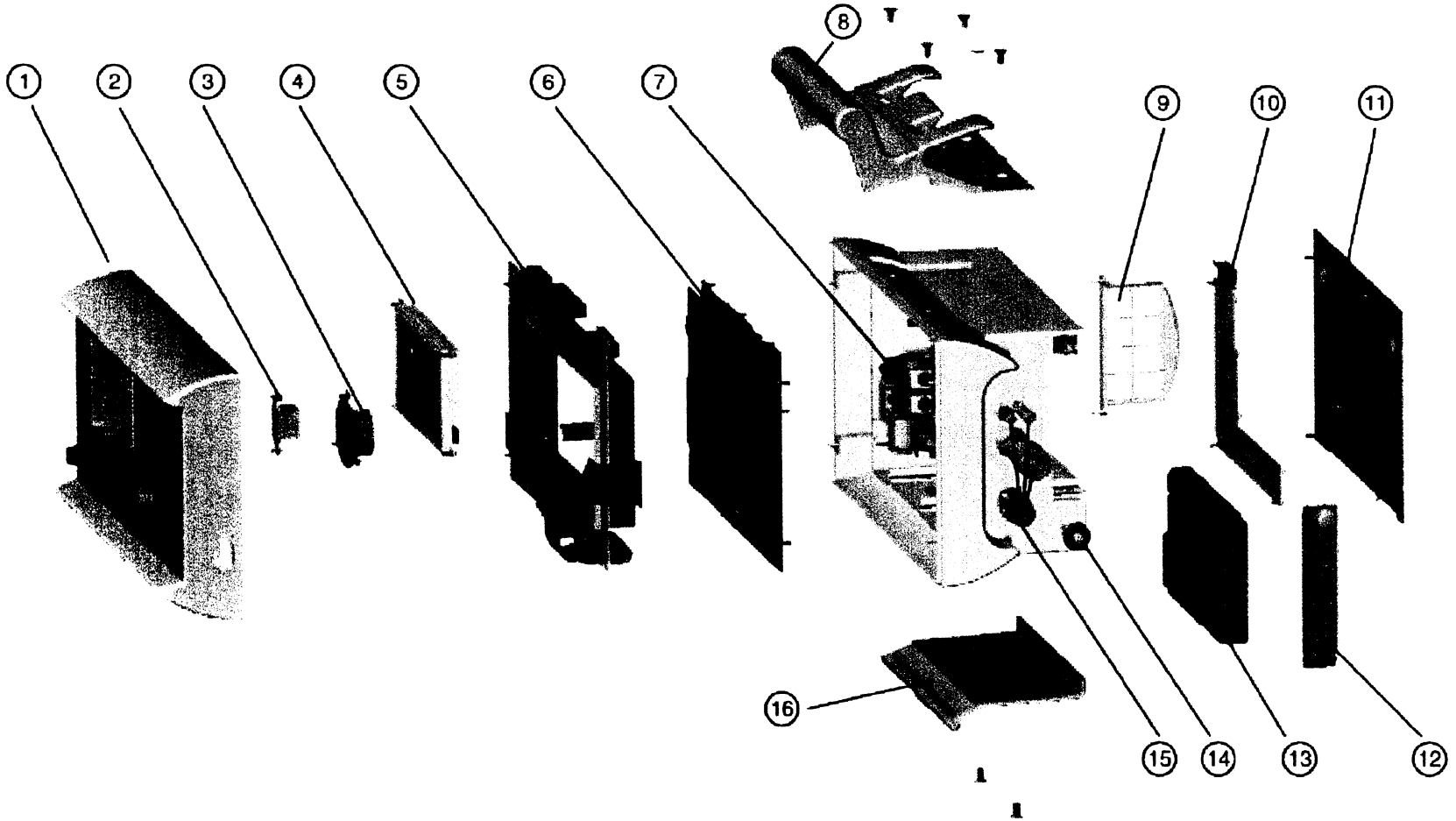

Fig.1 General overview, for legend see Table 1

Table 1 Legend Fig.1

Item	Designation
1	Front section with potentiometer, rotary encoder, membrane keypad and label inserts
2	Signal generator
3	Loudspeaker
4	Display
5	Control PCB (see also Fig.6)
6	Cover panel for pneumatic components
7	Pneumatic components and sensor PCB (see also Fig.3)
8	Handle
9	Filter element to filter the ambient air intake
10	Charging circuit PCB
11	Rear panel
12	Battery compartment cover
13	Replaceable battery
14	DC voltage socket
15	Sockets for flowmeter tubes, ventilation tube and compressed gas tube
16	Base plate

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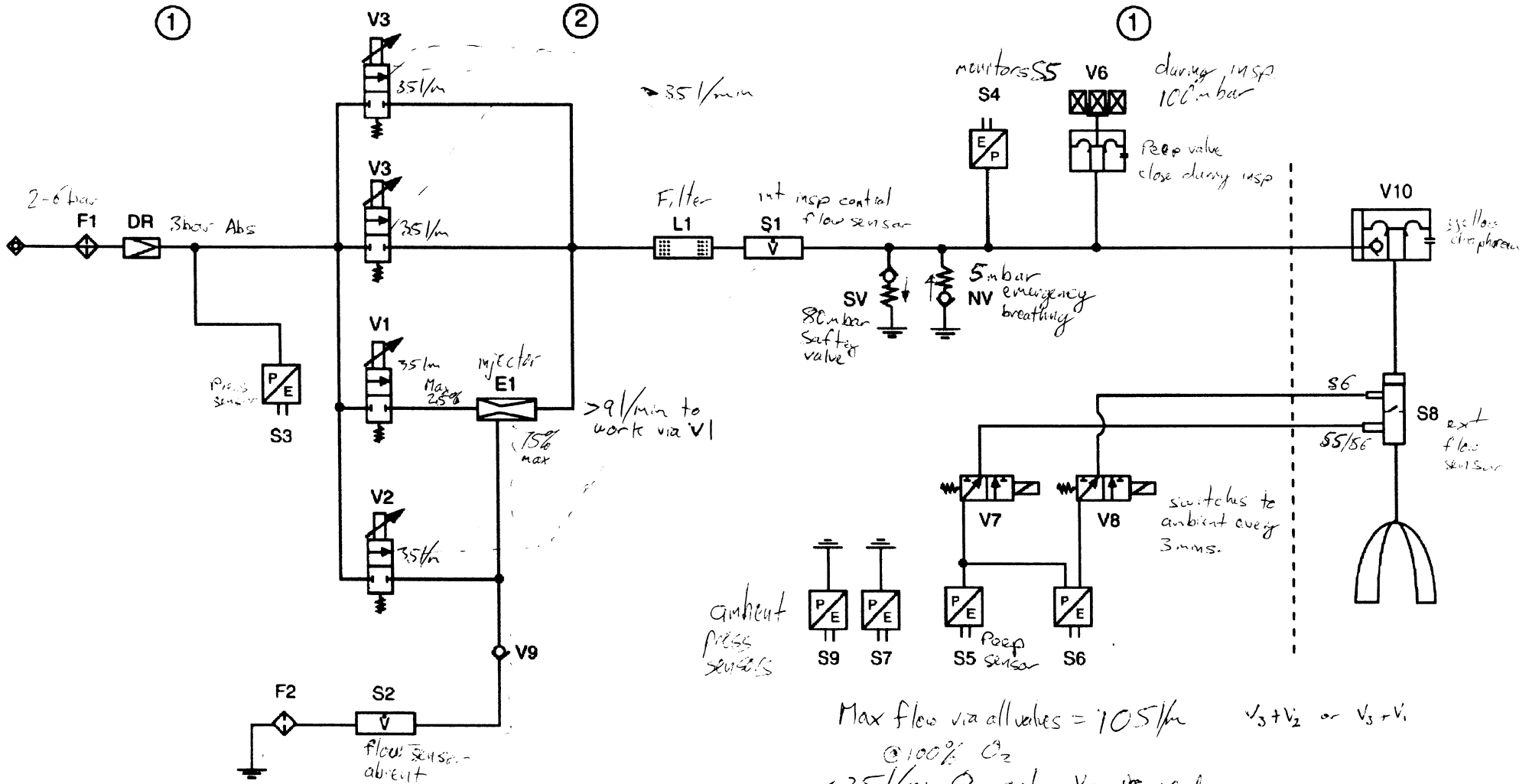

Fig.2 Pneumatic components diagram, for legend see Table 2

Table 2 Legend Fig.2 **and** Fig.3

Item	Designation
1	Connection block
2	Metering block
DR	Pressure regulator
E1	Ejector
F1	Filter in O2 compressed gas connection
F2	Filter for intake air
L1	L1 ensures uniform flow
NV	Emergency air valve
S1	Flow sensor to measure internal inspiratory flow
S2	Flow sensor to measure the ambient air intake
S3	Pressure sensor (Pv) to measure supply pressure for valves V1 to V3
S4	Pressure sensor (Pint) to measure unit-internal patient pressure
S5	Pressure sensor (Paw) to measure pressure close to patient
S6	Pressure sensor (delta P) to measure differential pressure at external flow sensor
S7 and S9	Pressure sensors to measure ambient pressure
S8	External flow sensor
SV	Safety valve
V1 to V3	Metering valves
V10	Ventilation valve
V6	PEEP valve

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Item	Designation
V7 and V8	Switching valves to calibrate pressure sensors S5 and S6
V9	Non-return valve

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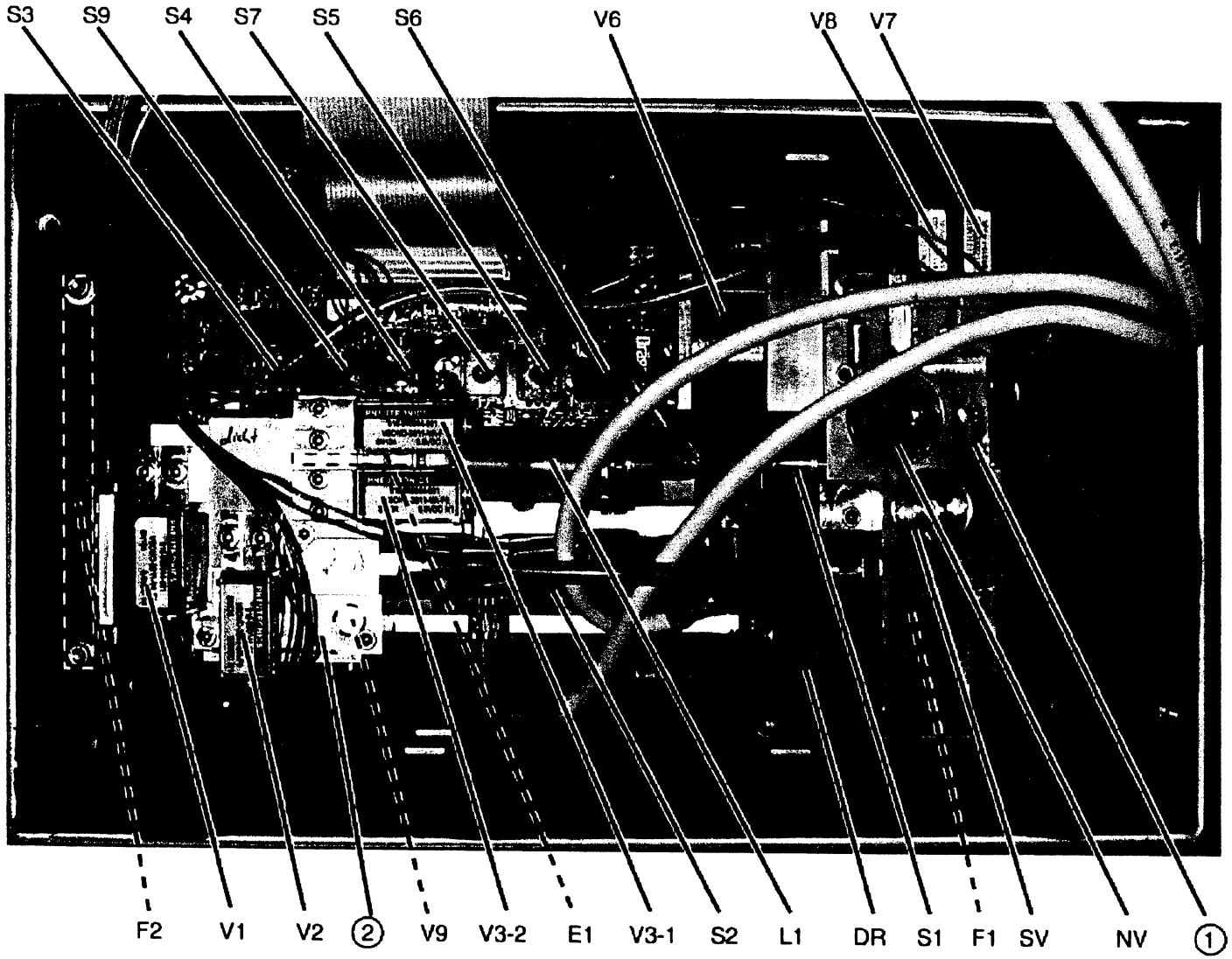

Fig.3 Overview of pneumatic components, for legend see Table 2

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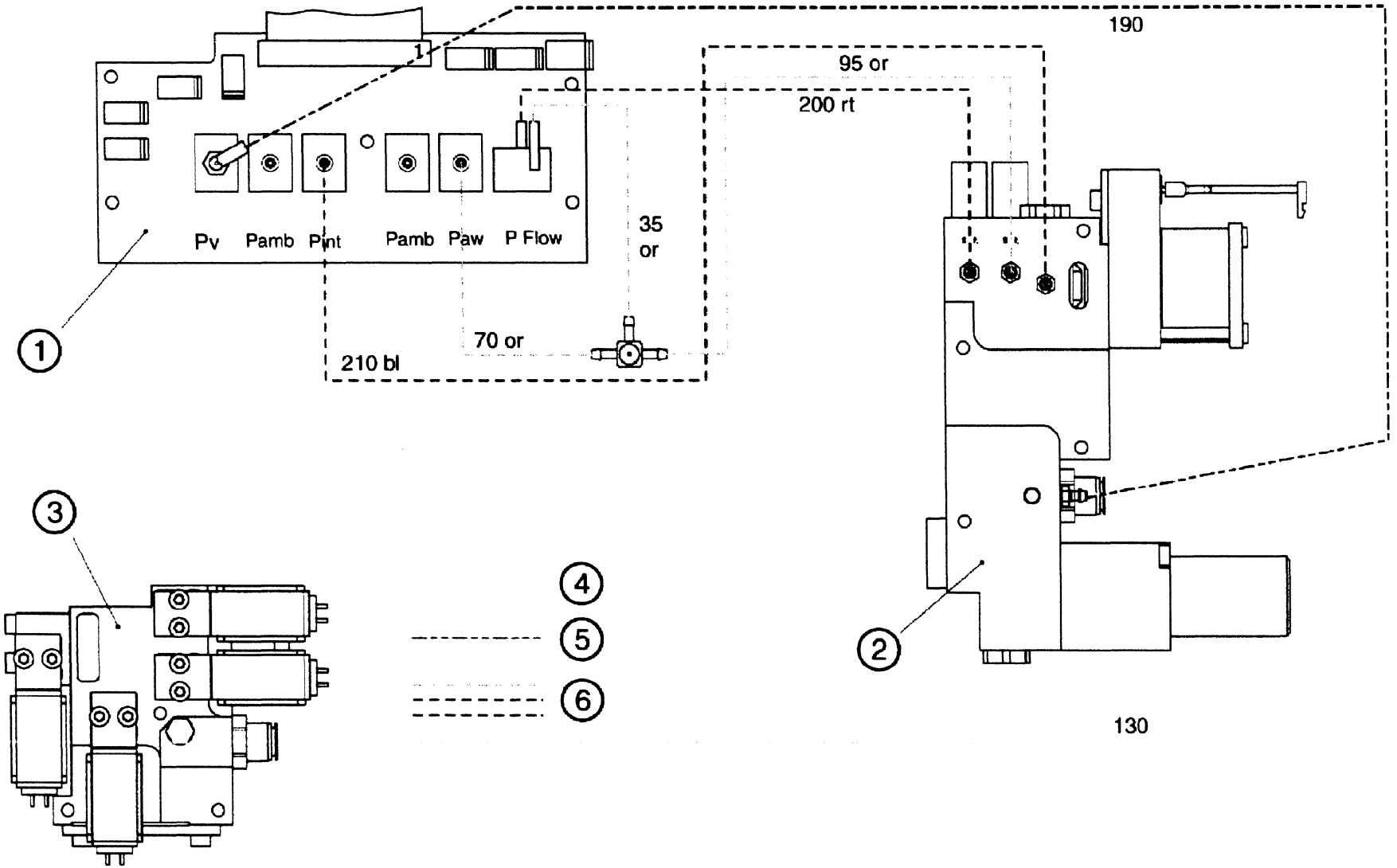

Fig.4 Tubing diagram, for legend see Table 3

Table 3 Legend Fig.4

Item	Designation
1	Sensor PCB
2	Connection block
3	Metering block
4	Tube 4x1 PAE not coloured (nc)
5	Tube 2x1.5 Si not coloured (nc)
6	Tube 2x1 Si blue (bl), red (rd), orange (or)

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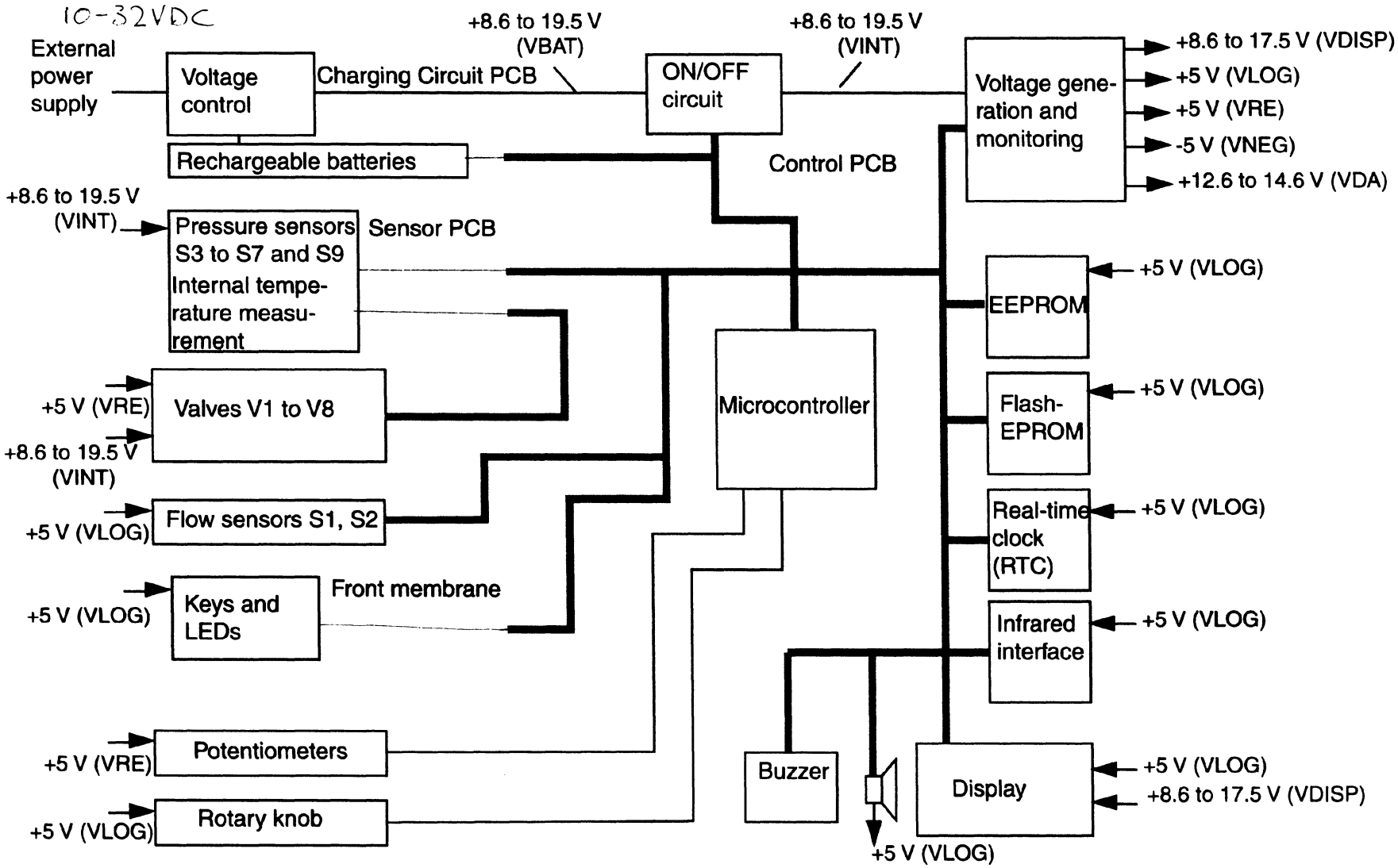

Fig.5 Electronics block diagram

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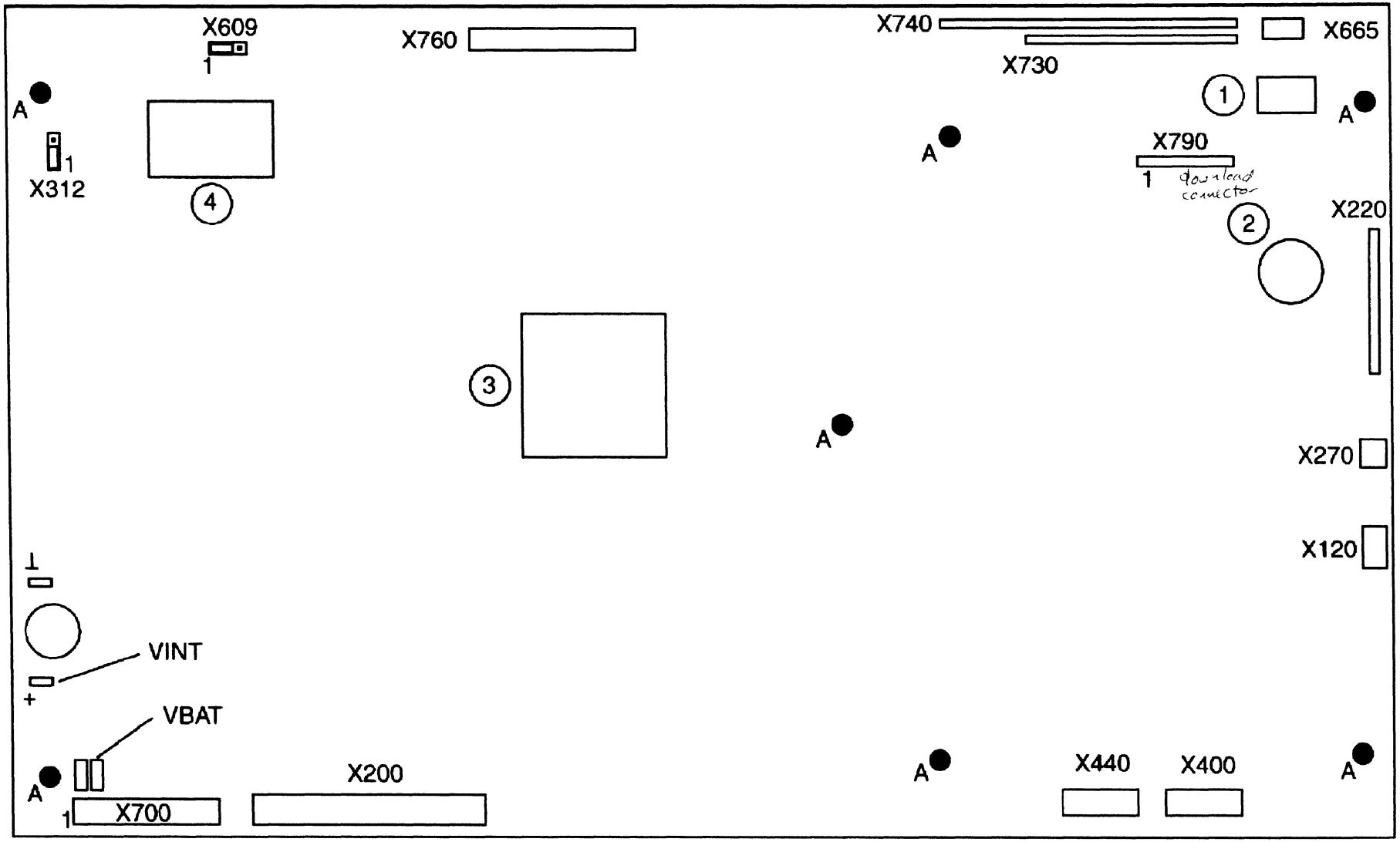

Fig.6 View of control PCB, for legend see Table 4

Table 4 Legend Fig.6

Item	Designation
1	EEPROM
2	Goldcap capacitor
3	Microcontroller
4	Real-time clock with battery
A	Control PCB fixing screws
X120	Connection to signal generator
X200	Connection to sensor PCB
X220	Connection to potentiometers
X270	Connection to loudspeaker
X312	Jumper to trigger a reset
X400	Connection to flow sensor S1
X440	Connection to flow sensor S2
X609	Jumper to perform the bootstrap download
X665	Connection to rotary encoder
X700	Connection to charging circuit PCB
X730	Connection to front membrane (keys)
X740	Connection to front membrane (LEDs)
X760	Connection to display
X790	Pin strip for bootstrap download

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Section 3

1 General introduction

Before opening the unit, observe the following warnings:

Before opening up the unit remove the compressed oxygen supply, the external power supply and the internal battery.

Electrostatic discharge may damage electrostatic sensitive devices. Use an anti-static mat and a wrist strap when handling when handling electrostatic sensitive devices.

2 Opening the unit

1. Switch off the unit.
2. Remove the external power supply, internal battery and compressed gas supply.
3. Remove screws Fig. 1.

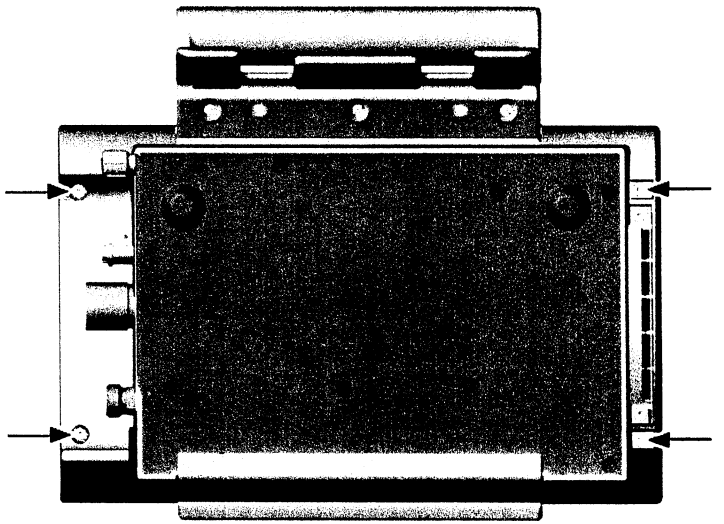

Fig. 1 Opening the unit

4. Open the unit
5. Remove the upper connectors Fig. 2.

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Opening the unit

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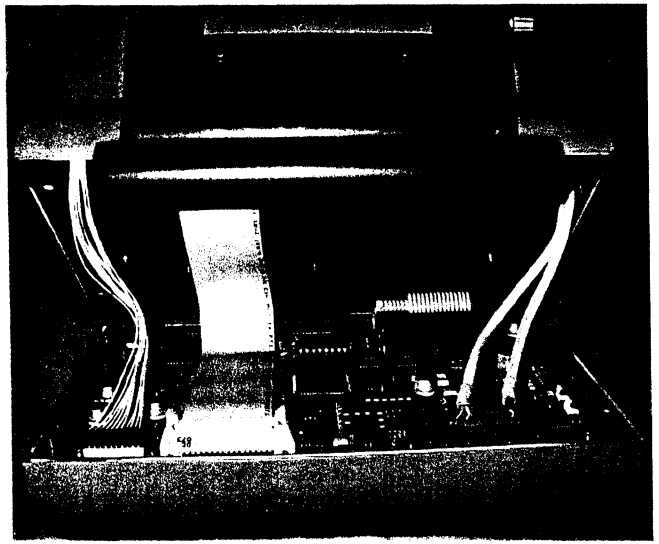

Fig. 2 Unit open

The unit is made up of two "halves". The control PCB is to visible in one half and a cover panel in the other.

Under the control PCB are the following components:

- The display
- The potentiometers
- The rotary encoder
- The loudspeaker
- The buzzer
- The label inserts for the membrane keypad.

To access these components, the fixing screws of the control PCB and the remaining connectors of the control PCB must be removed. Then the control PCB can be removed.

Under the cover panel are the pneumatic components. To access the pneumatic components, the fixing screws of the cover panel must first be removed, and then the cover panel itself.

1 Replacing the control PCB

The control PCB is located in the front of the Oxylog 3000. To replace the control PCB:

1. Switch on unit.
2. Make a note of the software version.
3. Switch off the unit.
4. Open the unit.
5. Mark the connectors to the flow sensors and remove them.
6. Unplug the remaining connectors from the control PCB.
7. Remove the control PCB fixing screws.
8. Remove the control PCB.

Pay attention to the polarity. If the polarity of some components is reversed they will be destroyed. Note the fitting position.

9. Remove the EEPROM and the battery of the real-time clock from the old control PCB and plug them into the new one.
10. Install the new control PCB.
11. Assemble the unit complete.
12. Check the software version.
13. If the software versions differ, run a download.
14. Call up ESM Test 039.
15. If the displayed software versions differ, update the charging circuit PCB software.
16. Check unit according to PMS Procedure.
17. Place fully functional unit at the user's/owner's disposal.

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2 Replacing the charging circuit PCB

The charging circuit PCB is located behind the rear panel of the Oxylog 3000. To replace the charging circuit PCB:

Electrostatic discharge may damage electrostatic sensitive devices. Use an anti-static mat and a wrist strap when handling when handling electrostatic sensitive devices.

Before opening up the unit remove the compressed oxygen supply, the external power supply and the internal battery.

On the charging circuit PCB is a fuse for the replaceable battery. Before replacing the PCB, check whether the fault lies in the fuse.

1. Switch off the unit.
2. Remove the compressed oxygen supply and the power supply.
3. Remove the internal battery (see also "Replacing the replaceable battery" in the Instructions for Use).
4. Remove the base plate fixing screws Fig. 1/1.

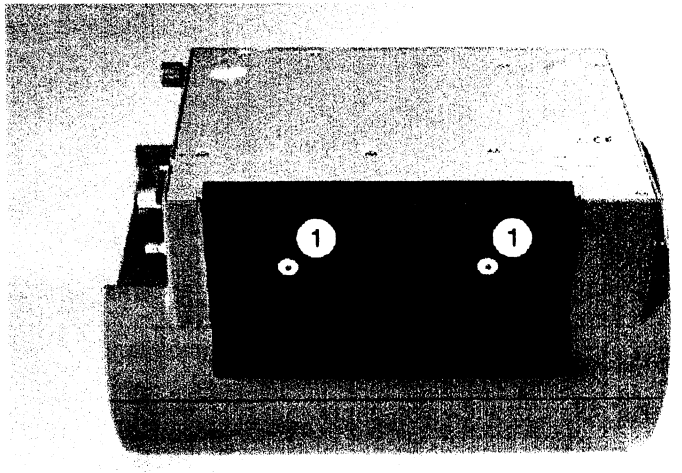

Fig. 1 Base plate fixing screws

5. Remove base plate.
6. Remove the rear panel fixing screws Fig. 2/2.

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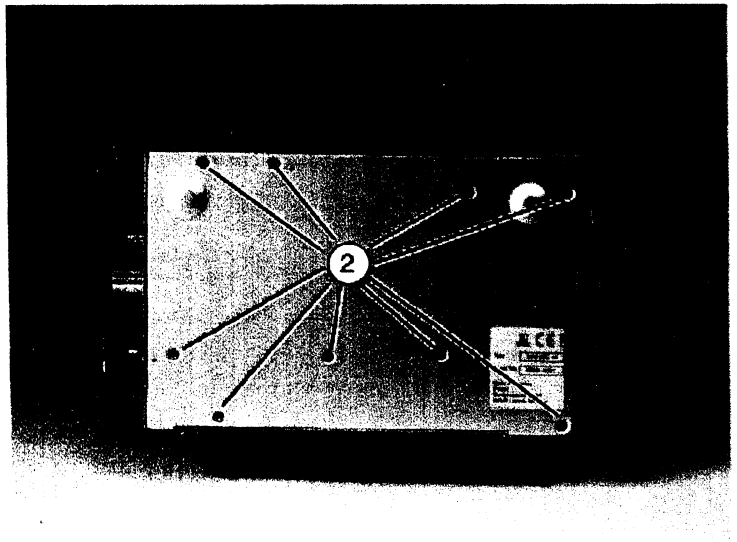

Fig. 2 Rear panel fixing screws

7. Remove rear panel.
8. Remove connector Fig. 3/4.
9. Remove the charging circuit PCB fixing screws Fig. 3/5.
10. Remove the old charging circuit PCB.
11. Unsolder cable Fig. 3/3 of power supply socket on charging circuit PCB.

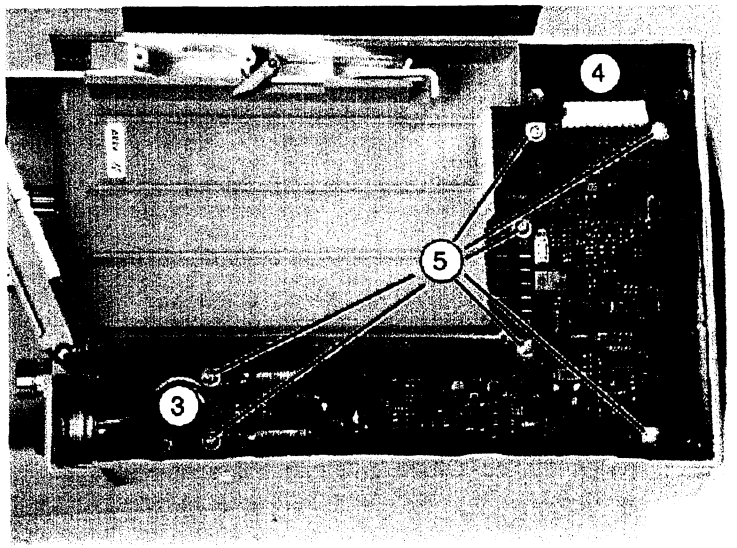

Fig. 3 View of charging circuit PCB

12. Install the new charging circuit PCB.
13. Assemble the unit complete.
14. Call up ESM Test 039.
15. If the displayed software versions differ, update the charging circuit PCB software.
16. Check power supply according to PMS Procedure.
17. Place fully functional unit at the user's/owner's disposal.

3 Adjusting the safety valve

This section describes the adjustment and testing of the safety valve. The specified test values are the values applicable at the date of publication. For the latest test values refer to the relevant PMS Procedure.

1. Open the unit.
2. Connect the compressed oxygen and the electric power.
3. Connect pressure gauge to ventilation tube connector (the connection must be sealed tight).
4. Call up Test 034 in the ESM and generate a flow of 20 L/min.
5. Set safety valve Fig. 4/SV to 80 mbar +/-5 mbar (105 mbar +/-5 mbar for US unit 2M86965).

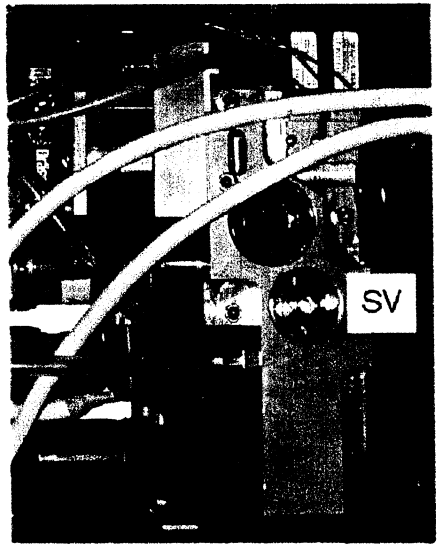

Fig. 4 Safety valve

6. Call up Test 034 in the ESM. Generate a flow of 100 L/min and actuate the PEEP valve at 130 mA.

   The pressure may be maximum 90 mbar.
7. End test.
8. Secure screw of safety valve with screw locking varnish.
9. Switch off the unit and assemble it complete.
10. Carry out a unit test.
11. Place fully functional unit at the user's/owner's disposal.

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4 Replacing the sensor PCB

The sensor PCB is located in the pneumatic components section of the Oxylog 3000. To replace the sensor PCB:

1. Open the unit.

⚠ **The socket of the pressure sensor S3 may snap. Remove the tube of pressure sensor S3 first only from the connector block.**

2. Make a note of the connector and tubing fitting locations.
3. Remove the connectors and tubing from the sensor PCB.
4. Remove the sensor PCB fixing screws Fig. 5.

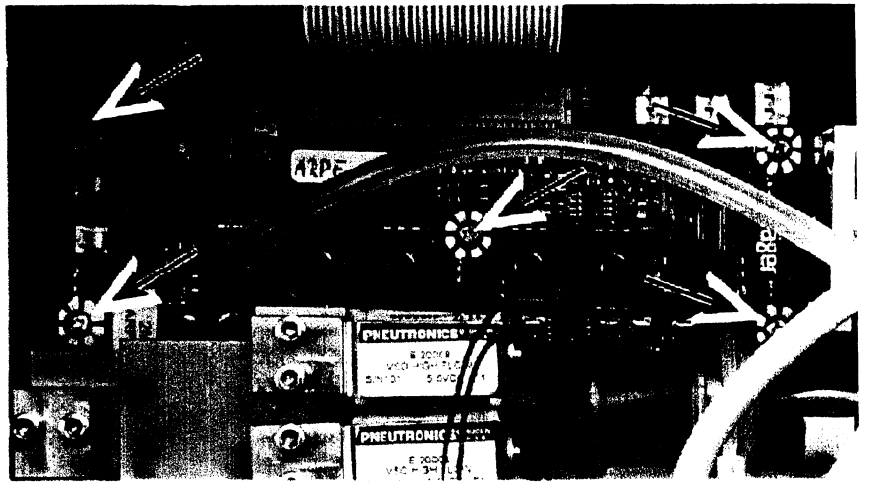

Fig. 5 View of sensor PCB

1. Remove the sensor PCB.
2. Carefully remove the tube from the angular bush of sensor S3 and fit it on the new sensor PCB.
3. Install the new sensor PCB.
4. Assemble the unit complete.
5. Calibrate pressure sensors S4, S7 and S9.
6. Carry out a unit test and check ventilation according to PMS Procedure.
7. Place fully functional unit at the user's/owner's disposal.

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5 Replacing the PEEP valve

The PEEP valve is located in the pneumatic components section of the Oxylog 3000. To replace the PEEP valve:

1. Open the unit.
2. Remove the connector Fig. 6/1 of the PEEP valve from the sensor PCB.
3. Remove the two PEEP valve fixing screws Fig. 6/2.

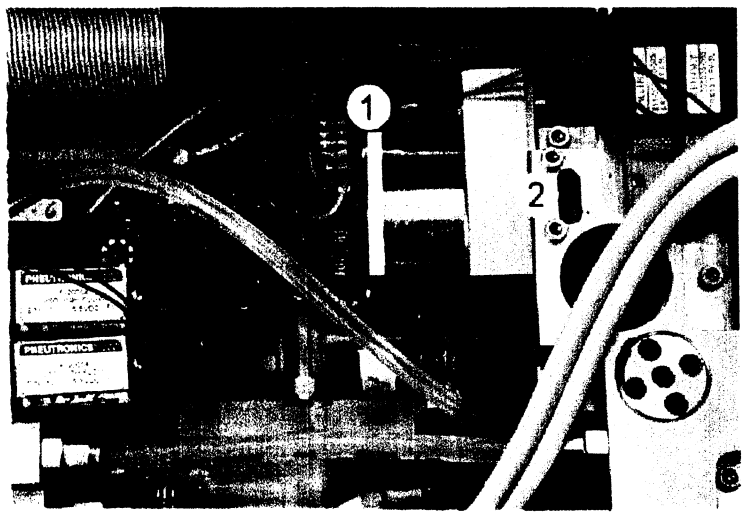

Fig. 6 Removing the PEEP valve

1. Remove PEEP valve.
2. Install new PEEP valve.
3. Assemble the unit complete.
4. Calibrate pressure sensor S4 in ESM Test 032.
5. Call up ESM Test 026 and pre-age the PEEP valve.
6. Call up ESM Test 037 and calibrate the PEEP valve.
7. Check ventilation according to PMS Procedure.
8. Place fully functional unit at the user's/owner's disposal.

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6 Replacing the connector block

The connector block is located in the pneumatic components section of the Oxylog 3000. To replace the connector block:

1. Switch off the unit.
2. Remove the compressed oxygen supply and the power supply.
3. Remove the sockets for the external flow sensor Fig. 7/1, ventilation tube Fig. 7/2 and compressed oxygen supply Fig. 7/3.

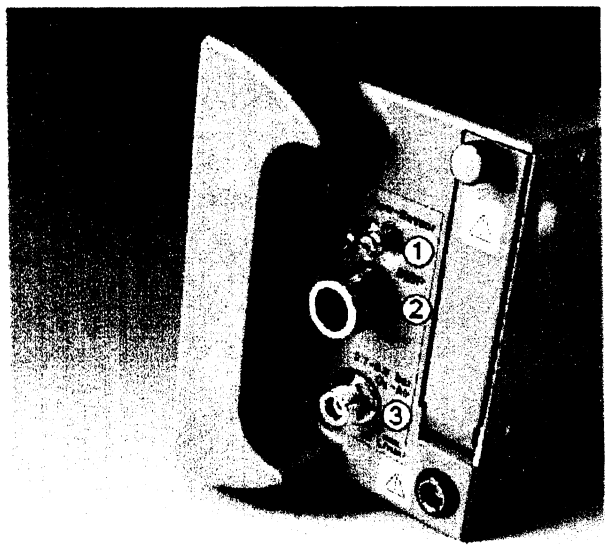

Fig. 7 Sockets

4. Open the unit.
5. Remove the tubes Fig. 8/1 from the connector block.
6. Remove the connectors of valves V6 (PEEP valve), V7 and V8 from the sensor PCB Fig. 8/2.

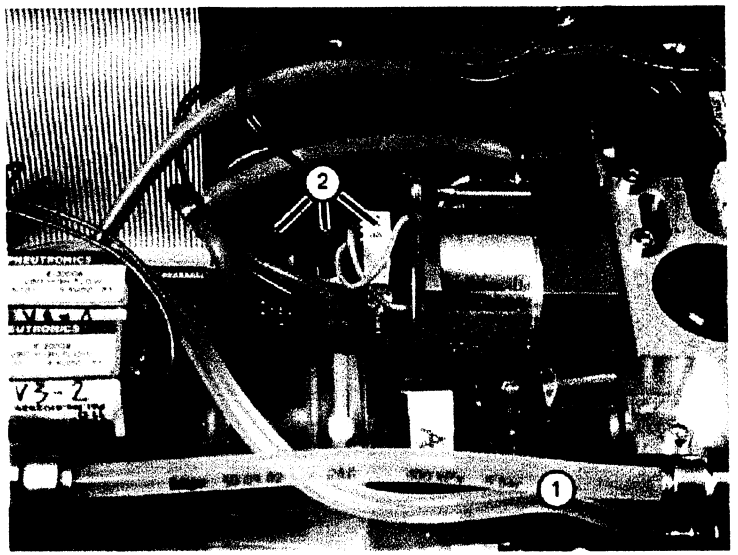

Fig. 8 Internal connections of the connector block

7. Remove the connector block fixing screws Fig. 9/3.

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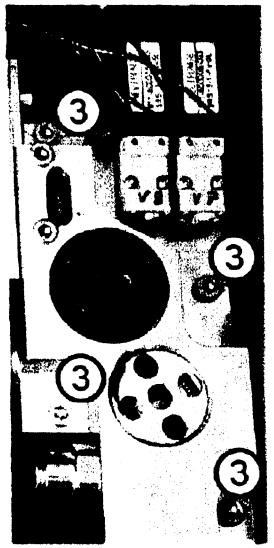

Fig. 9 Connector block fixing screws

⚠ **The flow sensors have a specific fitting position. Note the fitting position, direction and horizontal orientation of the flow sensors.**

8. Lift the connector block out of the unit slightly, rotate it and remove the flow sensor from the connector block.
9. Note the tube fitting locations on the connector block.
10. Remove the tubes from the connector block.
11. Remove the connector block from the unit.
12. Remove the fixing screws of the PEEP valve Fig. 10/1, of valves V7 and V8 Fig. 10/2 and of the pressure reducer Fig. 10/3 and remove the components (including O-rings) from the connector block.

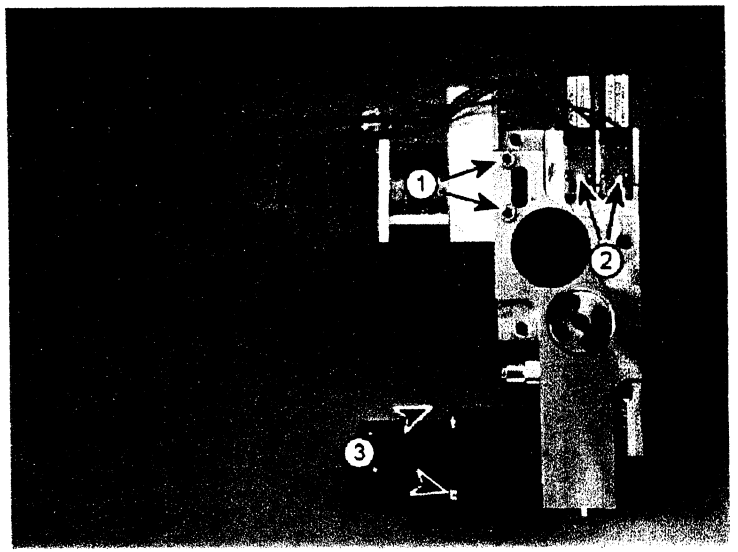

Fig. 10 Valves on the connector block

13. Install the new connector block.
14. Assemble the unit complete.
15. Check unit according to PMS Procedure.
16. Place fully functional unit at the user's/owner's disposal.

7 Replacing the metering block

The metering block is located in the pneumatic components section of the Oxylog 3000. To replace the metering block:

1. Switch off the unit.
2. Remove the compressed oxygen supply and the power supply.
3. Open the unit.

Mark valves V1 to V3 before removing them. The label is located at the relevant connector on the sensor PCB.

4. Remove the tube Fig. 11/1 from the metering block.
5. Remove the fixing screws of valves V1 to V3 Fig. 11/2.
6. Remove the valves and O-rings from the metering block.

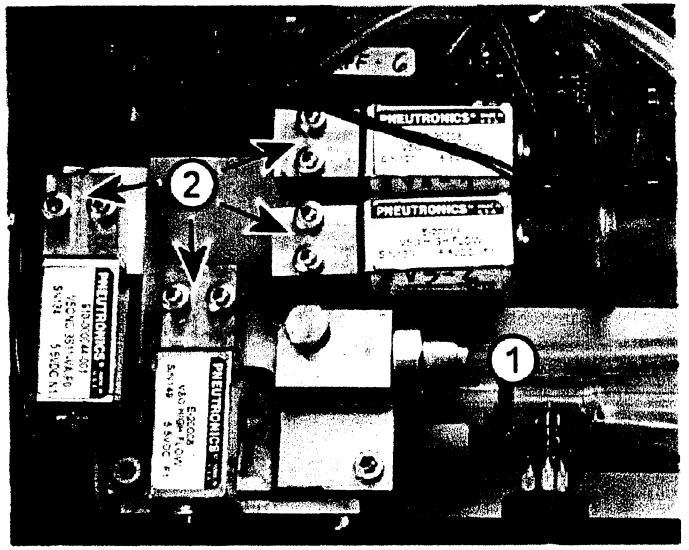

Fig. 11 Valves on the metering block

7. Remove the cable ties Fig. 12/3.
8. Remove the metering block fixing screws Fig. 12/4.
9. Lift the metering block out of the unit slightly and remove flow sensor S2 and the connection for flow sensor S1 from the metering block.
10. Remove the metering block from the unit.

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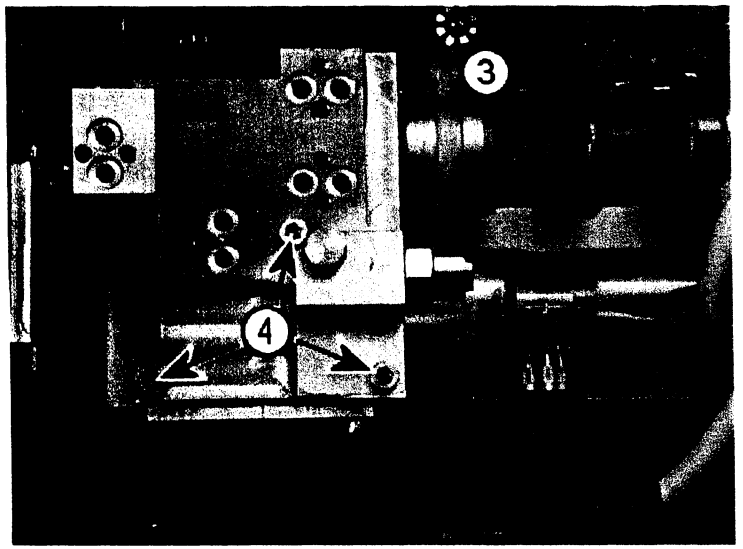

Fig. 12 Metering block mounting

11. Install the new metering block.
12. Assemble the unit complete.
13. Carry out a unit test.
14. Place fully functional unit at the user's/owner's disposal.

8 Replacing valves V1, V2, V3

The valves are located in the pneumatic components section of the Oxylog 3000. Replacement of the individual valves is similar in each case.

The following describes replacement of valve V1 by way of an example. To replace valve V1:

1. Switch off the unit.
2. Remove the compressed oxygen supply and the power supply.
3. Open the unit.
4. Remove the connector Fig. 13/1 of valve V1 from the sensor PCB.
5. Remove the fixing screws Fig. 13/2 of valve V1.

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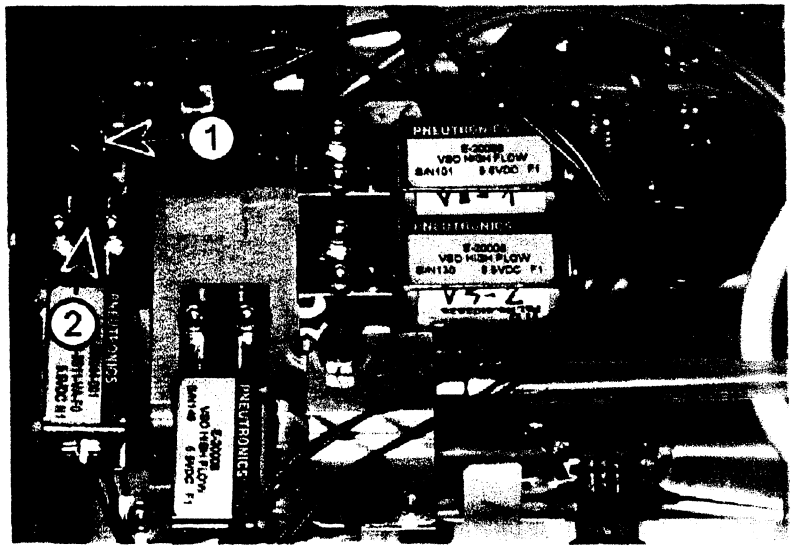

Fig. 13 Valve V1 mounting

6. Remove valve V1.
7. Install the new valve V1.

⚠ The cables of the valves may cause disturbance on the sensor PCB. Do not lay the valve cables over the sensor PCB.

1. Assemble the unit complete.
2. Check the setting of the pressure reducer and correct it as necessary.
3. Call up ESM Test 031 and calibrate the ambient pressure sensors.
4. Call up ESM Test 035 and calibrate the flow sensors.
5. Call up ESM Test 026 and pre-age valve V1.
6. Call up ESM Test 036 and calibrate valve V1.
7. Check ventilation according to PMS Procedure.
8. Place fully functional unit at the user's/owner's disposal.

⚠ **The mode of functioning of valves V1, V2 and V3 is similar. However, V1 is of a different mechanical design and each valve is individually calibrated. Do not swap the valves.**

Section 4

1 General introduction

There are three categories of service mode:

- Customer Service Mode (CSM)
- Extended Service Mode (ESM)
- Debug mode (DEBUG)

Customer service mode includes, for example, tests to check the keys and the loudspeaker, and is described in the Instructions for Use. This section deals only with access to Customer Service Mode (2 Selecting Customer Service Mode).

Extended Service Mode (4 Extended Service Mode) includes, for example, tests to check the valves and to adjust the pressure regulator.

Debug mode (DEBUG) is for developers only, and is not dealt with here.

The display language in service mode is English, and cannot be switched to other languages.

1.1 Operation

Select and activate tests and test steps as follows:

- Select test/test step = turn knob.
- Activate test/test step = press knob.
- Interrupt test = press knob again.
- Quit test step = select "EXIT" and press knob.

The selection is indicated by an "asterisk *".

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2 Selecting Customer Service Mode

To access Customer Service Mode:

1. Turn the adjuster Fig. 1 /1 fully clockwise.
2. Switch on the unit by the Fig. 1 key/3 and at the same time press and hold down the Fig. 1 keys/2 until Customer Service mode appears.

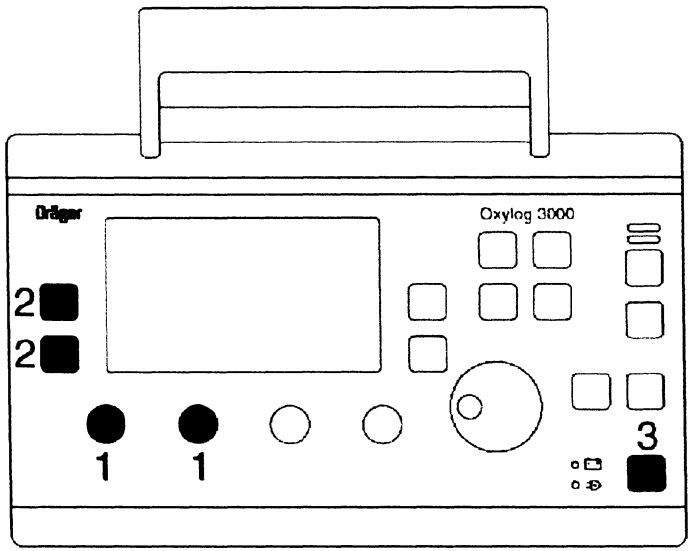

Fig. 1 Selecting service mode

Now the appropriate test can be selected and activated. To quit Service mode switch off the unit. The values set in Customer Service mode are retained and reactivated every time ventilation is started following power-up.

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3 Listing of test steps

Test no.	What is being tested/set?	Mode
000	No function.	CSM
001	Setting the start conditions.	CSM
002	Selecting the tubing system.	CSM
003	Setting the date and time.	CSM
004	Configuring the measured value window.	CSM
005	Enabling the software options.	CSM
→ 006	Testing the keys and potentiometers.	CSM
→ 007	Testing the loudspeaker, the buzzer, the LEDs and the display.	CSM
→ 008	Testing the battery voltage. Displaying the battery data and the external voltage supply.	CSM
009	Displaying technical faults.	CSM
010	Displaying stored events.	CSM
011	Setting the relevant ventilation mode.	CSM
012	Displaying the alarm and information messages in various languages.	CSM

222 press knob

Test no.	What is being tested/set?	Mode
013 to 019	No function.	
020	Displaying the internal temperature.	ESM
021	Displaying the analog values of the AD converter.	ESM
022	Setting flow and PEEP values.	ESM
023	Setting metering valves V1 to V3.	ESM
024	Testing automatic zeroing of S5 and S6.	ESM
025	Resetting the service hours and the log.	ESM
026	Ageing metering valves V1 to V3 and the PEEP valve.	ESM
027	Displaying the internal supply voltages.	ESM
028 to 029	No function.	
030	Initializing the EEPROM and the real-time clock.	ESM
031	Calibrating ambient pressure sensors S7 and S9.	ESM

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Test no.	What is being tested/set?	Mode
032	Calibrating pressure sensor S4.	ESM
033	Setting the pressure regulator and the gas type.	ESM
034	Setting safety valve SV.	ESM
035	Calibrating the flow sensors.	ESM
036	Calibrating metering valves V1 to V3.	ESM
037	Calibrating the PEEP valve.	ESM
038	Displaying the calibration values.	ESM
039	Loading a new charging circuit software release.	ESM
040 to 199	No function.	
200	Activating Debug mode.	ESM
201 to 221	Reserved for Debug mode.	
222	Activating Extended Service Mode	ESM
223 to 250	Reserved for Debug mode.	

4 Extended Service Mode

4.1 Selecting Extended Service Mode

To access Extended Service mode:

1. Select Customer Service mode (2 Selecting Customer Service Mode).
2. Select test 222.
3. Press turn knob until "Extended Service Mode" appears.
4. Press turn knob again (to confirm message).

Now the appropriate test can be selected and activated.

4.2 Description of test steps

Test steps 1 to 12 are in Customer Service Mode and are described in the Instructions for Use. Test steps 13 to 19 and 28 to 29 have no function.

The numbers in circles do not appear on the Oxylog 3000 screen and are presented here for orientation only. The lines marked by an asterisk "*" can be selected on the device. The device itself displays only an asterisk "*" for the selected line.

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The abbreviation ATP stands for "Ambient Temperature Pressure". Measured to ambient pressure, 25 °C, dry air.

4.2.1 Test 020

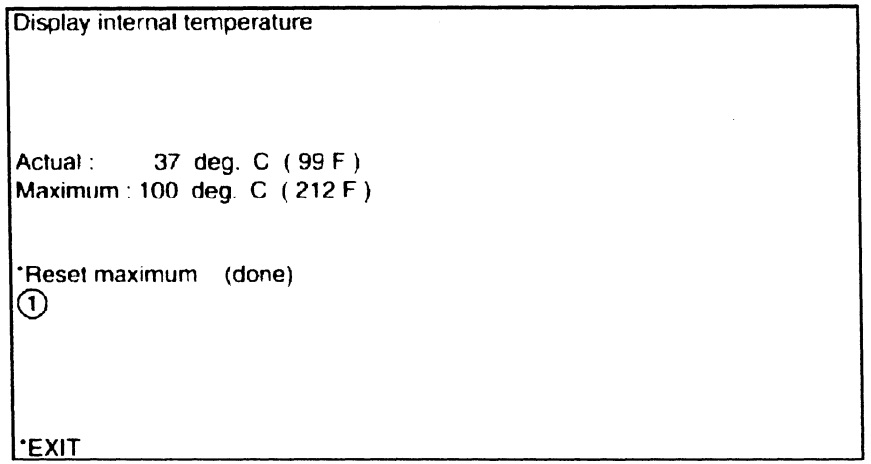

Fig. 2 View of test 020

In this test the internal temperature and the maximum internal temperature reached are displayed. The maximum can be reset (1).

4.2.2 Test 021

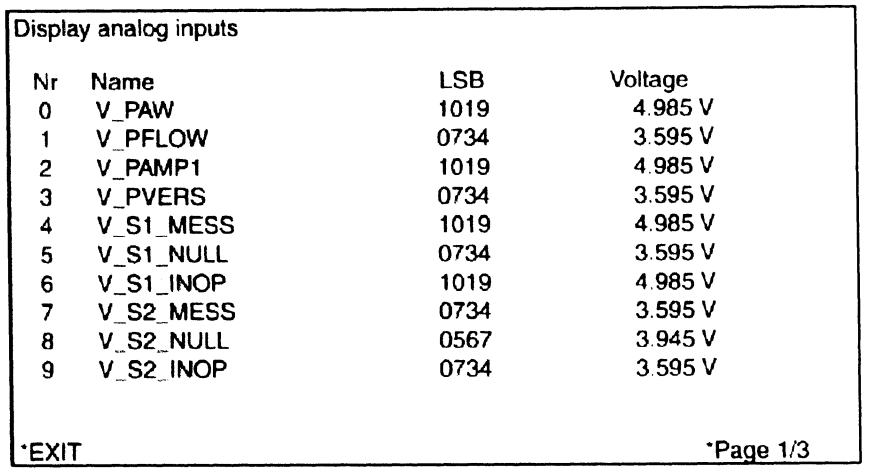
Display analog inputs
Nr Name LSB Voltage
0 V_PAW 1019 4.985 V
1 V_PFLOW 0734 3.595 V
2 V_PAMP1 1019 4.985 V
3 V_PVERS 0734 3.595 V
4 V_S1_MESS 1019 4.985 V
5 V_S1_NULL 0734 3.595 V
6 V_S1_INOP 1019 4.985 V
7 V_S2_MESS 0734 3.595 V
8 V_S2_NULL 0567 3.945 V
9 V_S2_INOP 0734 3.595 V
*EXIT
*Page 1/3

Fig. 3 View of test 021

In this test the analog values of the AD converter are displayed.

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4.2.3 Test 022

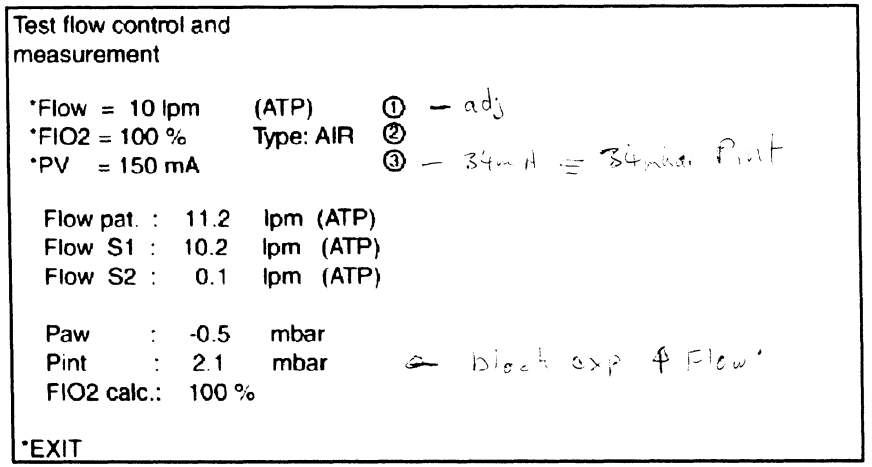
Test flow control and measurement
*Flow = 10 lpm (ATP)
*FIO2 = 100 % Type: AIR
*PV = 150 mA
Flow pat. : 11.2 lpm (ATP)
Flow S1 : 10.2 lpm (ATP)
Flow S2 : 0.1 lpm (ATP)
Paw : -0.5 mbar
Pint : 2.1 mbar
FIO2 calc.: 100 %
*EXIT

Fig. 4 View of test 022

In this test step the flow (1), the O2 concentration (2) and the actuation of the PEEP valve (3) can be adjusted. The following measured values are also displayed:

- Inspiratory flow "Flow pat."
- Flow through sensor S1 "Flow S1"
- Flow through sensor S2 "Flow S2"
- Airway pressure "Paw"
- Internal pressure at S4 "Pint"
- O2 concentration during calibration "FIO2 calc."

This test checks, for example, whether valves V1 to V3 have a leakage flow. To perform the test:

Set flow to zero and seal off socket of ventilation tube. No pressure must build up.

4.2.4 Test 023

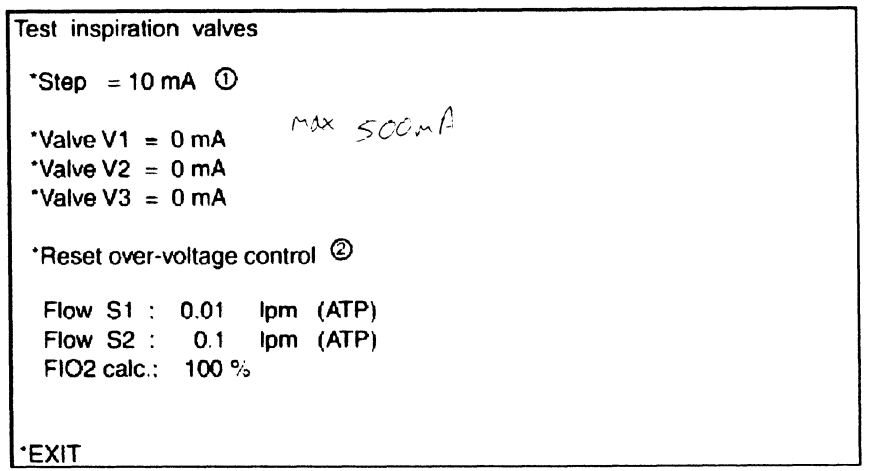
Test inspiration valves
*Step = 10 mA
*Valve V1 = 0 mA
*Valve V2 = 0 mA
*Valve V3 = 0 mA
*Reset over-voltage control
Flow S1 : 0.01 lpm (ATP)
Flow S2 : 0.1 lpm (ATP)
FIO2 calc.: 100 %
*EXIT

Fig. 5 View of test 023

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In this test step inspiratory valves V1 to V3 can be actuated. The stepwidth can be set to 1 mA or 10 mA (1). The actuation can be reset (2). The following measured values are also displayed:

- Flow through sensor S1 "Flow S1"
- Flow through sensor S2 "Flow S2"
- O2 concentration during calibration "FIO2 calc."

4.2.5 Test 024

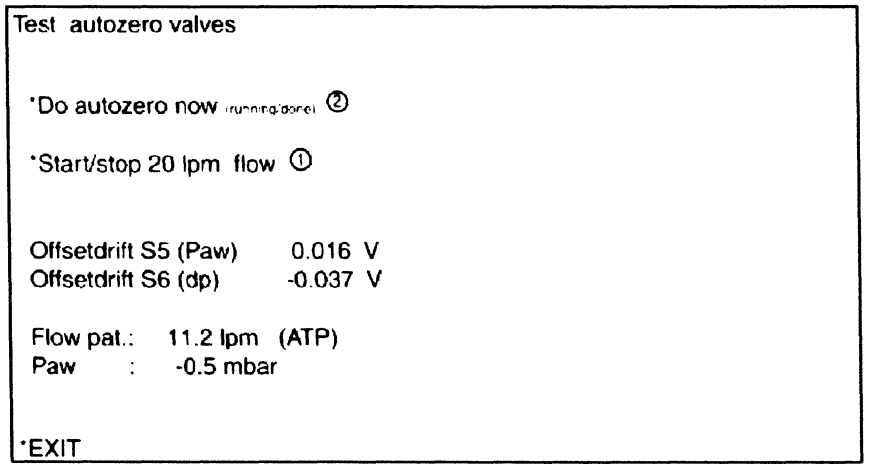
Test autozero valves
*Do autozero now (running/done) ②
*Start/stop 20 lpm flow ①
Offsetdrift S5 (Paw) 0.016 V
Offsetdrift S6 (dp) -0.037 V
Flow pat.: 11.2 lpm (ATP)
Paw : -0.5 mbar
*EXIT

Fig. 6 View of test 024

In this test step the automatic zeroing of sensors S5 and S6 can be checked as follows (for this test a test lung must be connected):

1. Briefly generate a flow of 20 L/min (activate/deactivate 1).

   The unit generates a flow of 20 L/min. The airway pressure increases.

2. Carry out automatic zeroing (activate 2).

   Sensors S5 and S6 are switched with V7 and V8 against atmosphere and a zeroing is carried out. If the offset values are outside the tolerance, a technical fault is generated (error log entry, test step 005). The following measured values are also displayed:

   - Inspiratory flow "Flow pat."
   - Airway pressure "Paw"

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4.2.6 Test 025

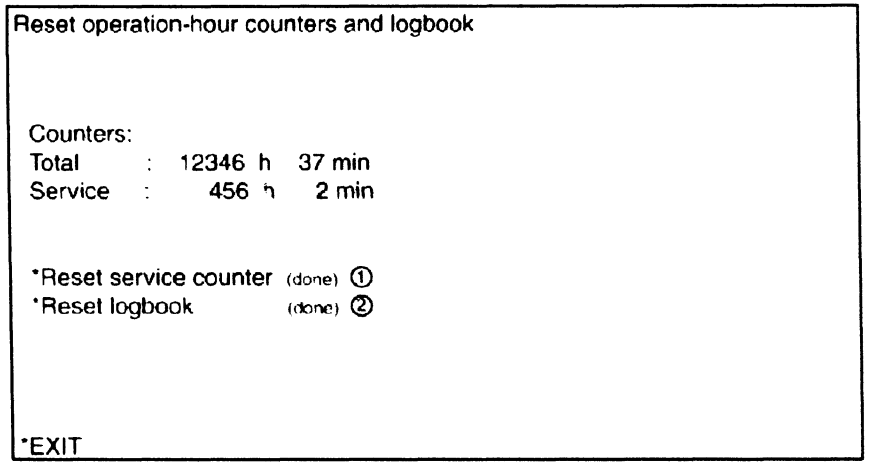
Reset operation-hour counters and logbook
Counters:
Total : 12346 h 37 min
Service : 456 h 2 min
*Reset service counter (done) ①
*Reset logbook (done) ②
*EXIT

Fig. 7 View of test 025

In this test step the service hours meter (1) and/or the log (2) can be reset. The total number of hours and total number of service hours are additionally displayed.

4.2.7 Test 026

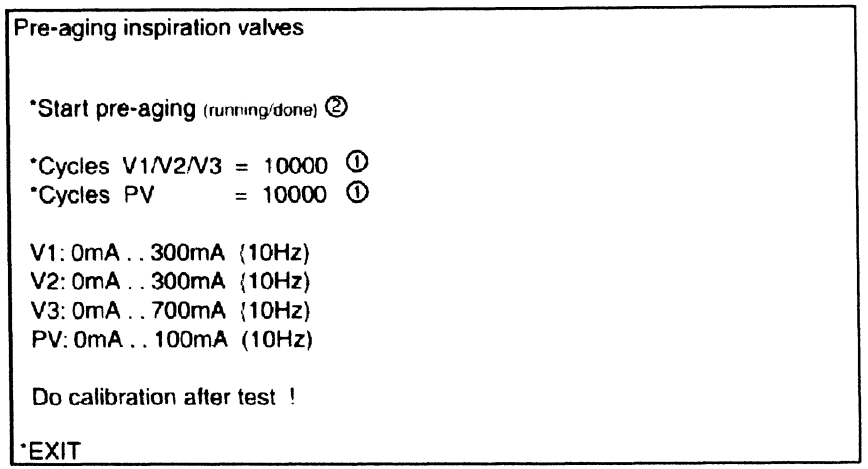
Pre-aging inspiration valves
*Start pre-aging (running/done) ②
*Cycles V1/V2/V3 = 10000 ①
*Cycles PV = 10000 ①
V1: 0mA . . 300mA (10Hz)
V2: 0mA . . 300mA (10Hz)
V3: 0mA . . 700mA (10Hz)
PV: 0mA . . 100mA (10Hz)
Do calibration after test !
*EXIT

Fig. 8 View of test 026

⚠ **No adequate accuracy. The valves must be recalibrated after pre-ageing (see** 4.2.15 Test 036**).**

In this test step valves V1 to V3 and the PEEP valve can be "pre-aged". For this, the valves are clocked at 10 Hz. First valves V1 to V3 are actuated and then the PEEP valve. The number of switching cycles can be adjusted in increments of 1000 (1). Once the switching cycles have been set the actuation of the valves can be

started (2). The test can be aborted by pressing the knob. New valves are aged with approximately 10,000 increments during running-in.

4.2.8 Test 027

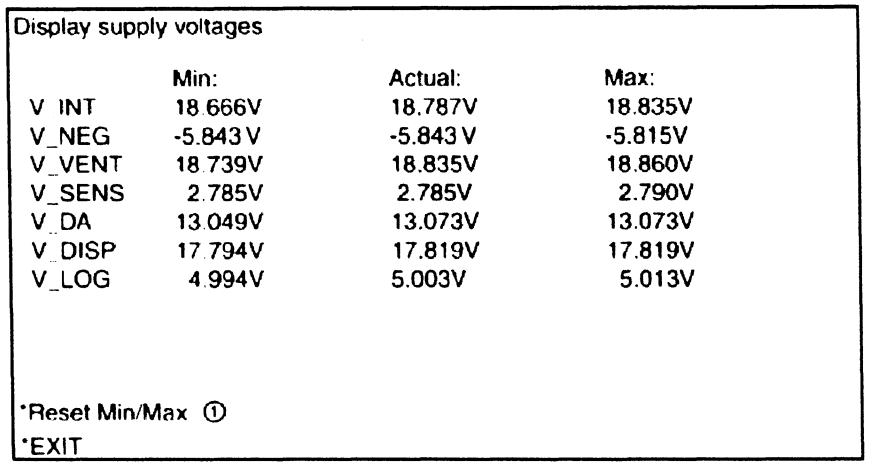

Fig. 9 View of test 027

In this test step the internal supply voltages are displayed. The minimum and maximum measured values (no tolerances) can be reset (1).

4.2.9 Test 030

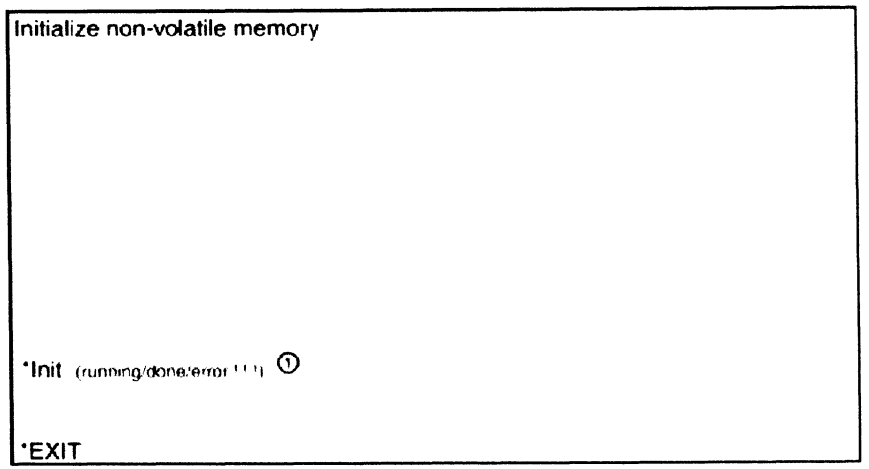

Fig. 10 View of test 030

In this test step the EEPROM and the real-time clock can be re-initialized. Any EEPROM checksum errors following a commissioning operation or a change of software are cleared.

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4.2.10 Test 031

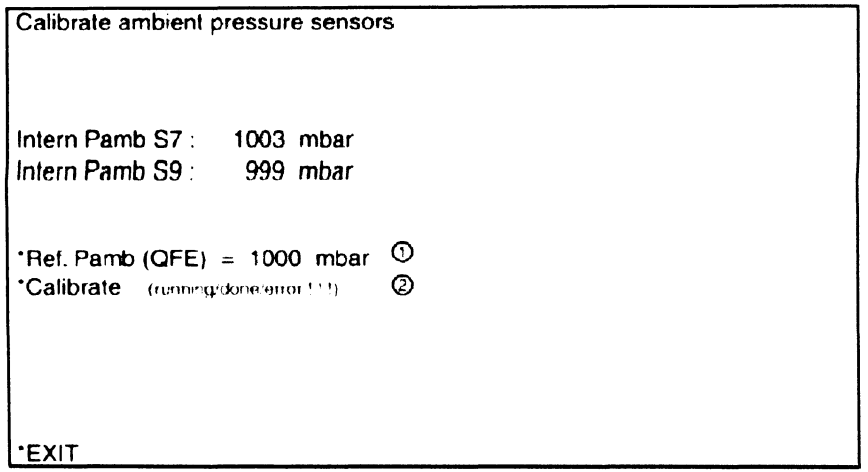
Calibrate ambient pressure sensors
Intern Pamb S7 : 1003 mbar
Intern Pamb S9 : 999 mbar
*Ref. Pamb (QFE) = 1000 mbar ①
*Calibrate (running/done/error ! ! !) ②
*EXIT

Fig. 11 View of test 031

In this test step the two ambient pressure sensors S7 and S9 can be calibrated (2). When this test step is selected the reference value (1) is set to the current measured value of S7.

When entering the reference value make sure the pressure is entered as an absolute (determination of pressure e.g. by inquiry to a meteorological office).

To calibrate, first enter a reference value (1) and then start calibration (2).

4.2.11 Test 032

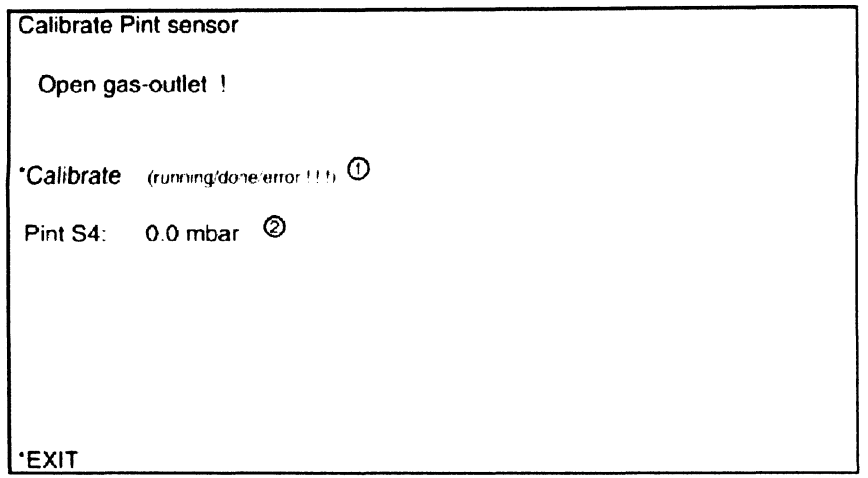

Fig. 12 View of test 032

In this test step pressure sensor S4 can be calibrated.

For calibration the system must be depressurized. Remove the ventilation tube prior to calibration.

For calibration, first detach the ventilation tube and then start calibration (1). The calibration value is displayed on-screen (2).

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4.2.12 Test 033

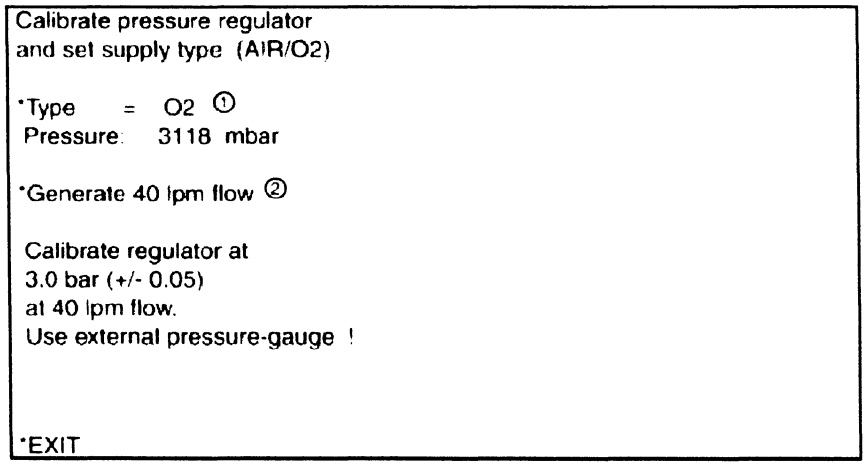

Fig. 13 View of test 033

In this test step the gas type with which the Oxylog 3000 is operated can be selected (1) and a flow of 40 L/min can be generated (2). This flow is needed to adjust the pressure reducer (see also Maintenance Procedures).

4.2.13 Test 034

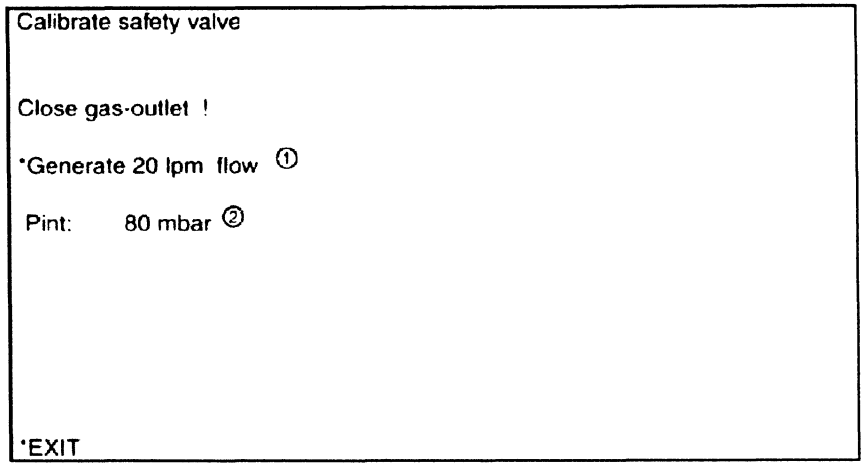

Fig. 14 View of test 034

In this test step a flow of 20 L/min can be generated (1) and the measured value of pressure sensor S4 (2) displayed. This flow is needed to adjust the safety valve (SV).

The displayed measured value is only accurate to +/- 5 mbar. To adjust the safety valve always use an external pressure gauge and seal off the connection for the ventilation tube.

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4.2.14 Test 035

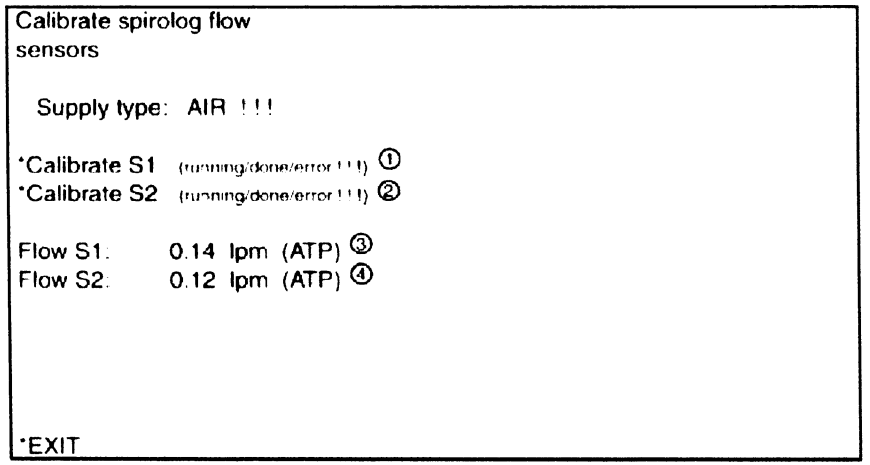
Calibrate spirolog flow sensors
Supply type: AIR ! ! !
*Calibrate S1 (running/done/error ! ! !) ①
*Calibrate S2 (running/done/error ! ! !) ②
Flow S1: 0.14 lpm (ATP) ③
Flow S2: 0.12 lpm (ATP) ④
*EXIT

Fig. 15 View of test 035

When the flow sensors are being calibrated there must be no flow in the system, the displayed propellant gas must be identical to the connected propellant gas, the connection for the ventilation tube must be open and the temperature in the Oxylog 3000 must not exceed 50 °C.

In this test step flow sensors S1 (1) and S2 (2) can be calibrated. The measured values of S1 (3) and S2 (4) are additionally displayed.

4.2.15 Test 036

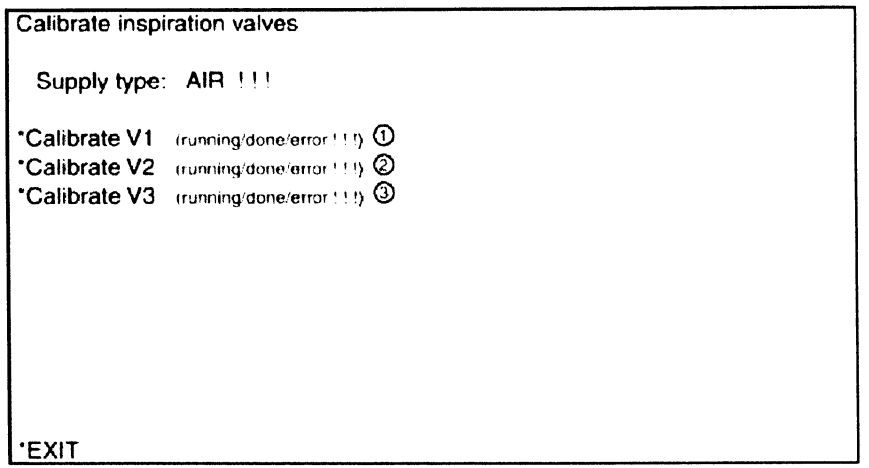
Calibrate inspiration valves
Supply type: AIR ! ! !
*Calibrate V1 (running/done/error ! ! !) ①
*Calibrate V2 (running/done/error ! ! !) ②
*Calibrate V3 (running/done/error ! ! !) ③
*EXIT

Fig. 16 View of test 036

In this test step valves V1 (1), V2 (2) and V3 (3) can be calibrated (recording of characteristics).

The valves can be calibrated with O2 or AIR, but the displayed propellant gas must be identical to the connected propellant gas. New valves must be pre-aged prior to calibration (see 4.2.7 Test 026).

4.2.16 Test 037

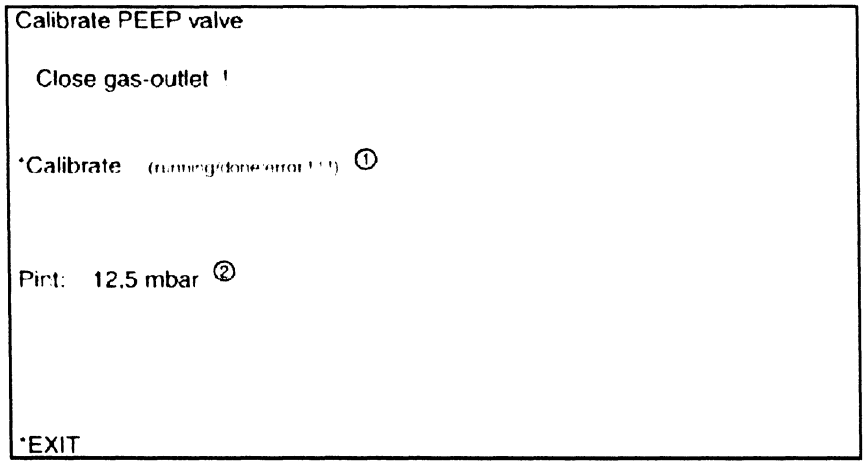

Fig. 17 View of test 037

In this test step the PEEP valve can be calibrated (1) (recording of characteristic). The measured value of pressure sensor S4 is additionally displayed (2). To calibrate the PEEP valve the connection for the ventilation tube must be sealed off.

A new PEEP valve must be pre-aged prior to calibration (see 4.2.7 Test 026).

4.2.17 Test 038

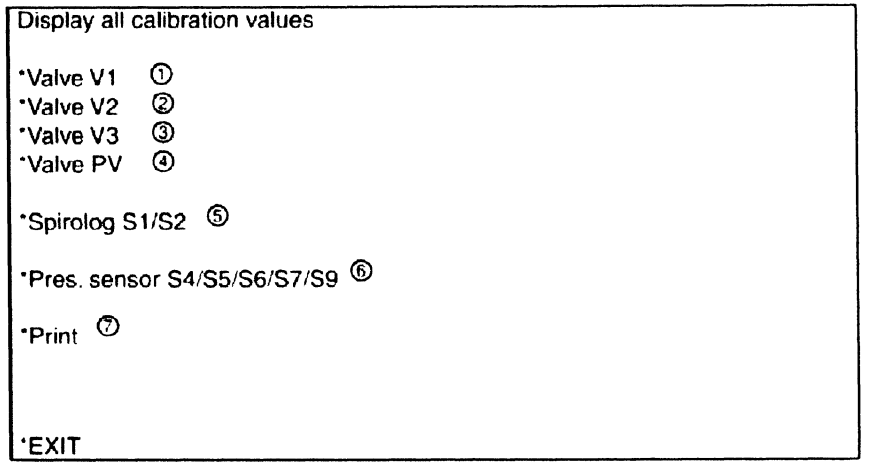

Fig. 18 View of test 038

In this test step the calibration data of the following valves and sensors are presented. The calibration data are stored in the EEPROM:

- Valve V1 (1)
- Valve V2 (2)
- Valve V3 (3)
- PEEP valve V6 (4)
- Flow sensors S1/S2 (5)
- Pressure sensors S4/S5/S6/S7/S9 (6)

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The calibration values can also be sent to the serial port (7) for printing, for example.

4.2.18 Test 039

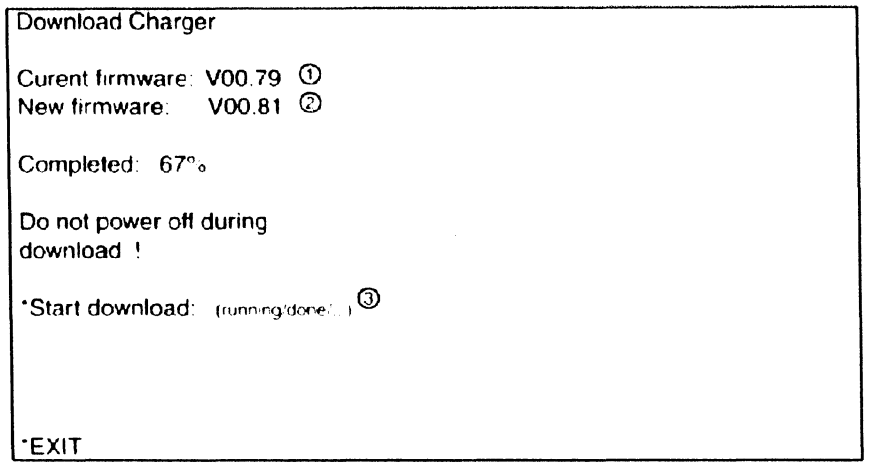

Fig. 19 View of test 039

Destruction of FLASH-PROM data. In the event of a power failure or if the unit is switched off during downloading, the data of the charging circuit PCB in the FLASH-PROM are destroyed. Run unit on mains power while downloading and do not switch it off.

In this test step a new software release for the charging circuit PCB can be installed (3). The software (1) currently on the charging circuit PCB and the software (2) on the control PCB are displayed. After installation the displayed software versions are identical.

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Section 5

Fault – cause – remedy

Oxyog 3000 classifies error messages according to three priority levels and identifies these accordingly with the aid of exclamation marks:

!!! Warning = Message with top priority

!! Caution = Message with medium priority

! Advisory = Message with low priority

The messages are listed in alphabetical order. The following list is intended to assist in identifying and rectifying the underlying cause of any faults triggering an alarm.

Messages in the Alarms window

Message	Cause	Remedy
! **21% oxygen**	The device has been set to medical air and may only be operated with medical air.	
!!! **Apnoea**	Spontaneous breathing by the patient has failed, or disconnection.	Ventilate in IPPV (CMV) mode. Ensure that hose connections are tight.
	Faulty flow sensor.	Replace flow sensor.
!!! **Apnoea ventilation** (only for CPAP)	The ventilator has automatically switched over to mandatory ventilation after detecting an apnoea (only in CPAP mode).	Check ventilation mode. Return to original ventilation mode: Press the »**Alarm Reset**« key.
!! **Charge int. battery**	Oxylog 3000 draws its power from the internal battery due to the absence of an external DC supply. Only a few minutes of operating time remain (typically 10 minutes).	The ventilator must immediately be reconnected to the mains supply, an onboard DC supply or a fully charged battery.
!! **Check settings flow**	The flow resulting from the settings for "Tidal volume **VT** per unit time" is impossible.	Change tidal volume **VT** or inspiratory time **Tinsp** or ventilation time ratio **I:E**.
! **Check settings O2** (only for optional "O2 blending")	The set O2 concentration cannot be achieved with the set flow.	Adjust inspiratory flow or O2 concentration (in accordance with measured value).
!! **Check settings time**	The expiration time resulting from the settings for **Freq.** and **I:E** or **Tinsp** is impossible.	Change **Freq.** or **I:E** or **Tinsp.**
!!! **Confirm device OFF with rotary knob**	Key »⏻« has been pressed for 3 seconds.	To switch off: confirm. To continue ventilation, press key »⏻« again.
!!! **Device failure**	Technical defect.	Call DrägerService.
!! **Flow measurement inop**	Measurement hoses for flow measurement on patient side buckled, disconnected or leaking.	Ensure measurement hoses for flow measurement on patient side are connected correctly.
	Flow sensor defective.	Replace flow sensor.
	Technical defect.	Call DrägerService – only restricted operation is now possible.
!! **Gas delivery failure**	Technical defect.	Call DrägerService – only restricted operation is now possible.

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	Message	Cause	Remedy
!!	**High frequency**	Patient breathes at a high spontaneous rate.	Check patient's condition, check ventilation pattern, correct alarm limit **fspn** if necessary.
!!	**Int. battery charging inop**	Technical defect.	Call DrägerService – only restricted operation is now possible.
!!!	**Int. battery discharged**	The operating time for operation with the internal battery has expired and an external DC supply has not been connected.	The ventilator must immediately be reconnected to a mains supply, an on-board DC supply or a fully charged battery.
!!	**Int. battery in use**	Oxylog 3000 draws its power from the internal battery due to the absence of an external DC supply.	Press »**Alarm Reset**« key to confirm alarm.
!!	**Key failed**	Technical defect.	Call DrägerService – only limited operation is now possible.
!!!	**Leakage** (not in NIV)	The measured expiratory tidal volume VT is approx. 40 % lower than the inspiratory value.	Repair leaks in patient system and possibly in tube. Use new flow measuring hoses.
		Faulty flow sensor.	Replace flow sensor.
		The ventilator may not function properly.	Call DrägerService.
!!	**Loss of data**	Technical defect.	Call DrägerService – only restricted operation is now possible.
!!	**Loudspeaker inop**	Technical defect.	Call DrägerService – only restricted operation is now possible.
!!!	**MV high**	The upper alarm limit for the minute volume MV has been exceeded.	Check patient's condition, check ventilation pattern, adjust alarm limits if necessary.
		Faulty flow sensor.	Replace flow sensor.
		The ventilator may not function properly.	Call DrägerService.
!!!	**MV low**	The minute volume MV has dropped below its lower alarm limit.	Check patient's condition, check ventilation pattern, adjust alarm limits if necessary.
		Leak in breathing system.	Ensure connections in breathing system are tight.
		Faulty flow sensor.	Replace flow sensor.
		The ventilator may not function properly.	Call DrägerService.
!!	**No int. battery ?**	Internal battery not fitted.	Fit battery or confirm alarm.
!	**No int. battery ?**	Internal battery not fitted.	Advisory message, is displayed continuously when confirmed.
!	**No int. battery charging**	Internal battery faulty or wrong battery fitted. Internal battery cannot be charged.	Change internal battery.
		Battery charge outside temperature range.	Note applicable temperature range for charging the internal battery.
!!!	**Paw high**	The alarm limit Pmax for the airway pressure has been reached. Patient "fights" the machine, coughing.	Check patient's condition, check ventilation pattern, adjust alarm limits if necessary.
		Ventilation hose kinked, stenosis.	Check hose system, breathing valve, tube.

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Message	Cause	Remedy
!!! **Paw low**	No pressure difference >5 mbar between inspiration and expiration or set pressure level is not achieved. Leak in cuff.	Inflate cuff and check for leaks.
	Leakage or disconnection.	Check hose system for leaking connections. Ensure that the breathing valve has been fitted correctly.
!! **Paw measurement inop**	Fault in measurement hoses for flow measurement on patient side.	Ensure measurement hoses for flow measurement on patient side are connected correctly.
	Technical defect.	Call DrägerService – only restricted operation is now possible.
! **Self test o.k.**	The device has been switched on and the self-test completed successfully.	The message can be confirmed or it will be cancelled automatically with the next message.
! **Settings not confirmed**	Parameters have been changed on the screen but not confirmed.	Press the rotary knob to confirm the parameter changes.
!!! **Supply pressure low**	Supply pressure <2.7 bar.	Ensure that supply pressure exceeds 2.7 bar.

Messages in the information window

(Numerical examples)

Message	Cause	Explanation/Remedy
f = 12 per min or **VT = 800 ml** **I : E = 1 : 1,5** **Flow = 15 L/min**	Change in Tinsp, f or VT in ventilation mode SIMV.	
f = 12 per min or **VT = 800 ml** **Tinsp = 0,7 s** **Flow = 35 L/min**	Change in I/E, f or VT in ventilation mode IPPV (CMV), IPPVAssist (CMVAssist)	
I : E = 1 : 1,5 **Tesp = 2 s**	Change in Tinsp or f in ventilation mode BIPAP (PCV+).	
Confirm PEEP above 10 mbar ?	PEEP >10 mbar has been set but not confirmed.	The required setting of PEEP >10 mbar is only possible when confirmed via the central rotary knob.
Gas consumption = 10 L/min	Standard display in information window for the current gas consumption.	
 (Battery capacity)	Standard display in information window for the current battery capacity.	
Pinsp >=PEEP + 3 mbar !	Set PEEP+ 3 mbar >Pinsp.	Set Pinsp > PEEP+ 3 mbar.
PASB = 22 mbar	Change in Δ ASB or PEEP.	PASB is the absolute pressure resulting from PEEP + Δ ASB.

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Section 6

1 Technical faults

1.1 Fault classification

Each fault is assigned to a fault group. In the event of a fault the relevant module must be replaced.

Fault group	Module/Fault	Text
1	Front	"FRONT: ..."
2	Charging circuit PCB	"CHARGER: ..."
3	Control PCB	"MAINBOARD: ..."
4	Potentiometer array	"POTI: ..."
5	Sensor PCB	"SENSOR: ..."
6	Flow sensor S1	"SPIR S1: ..."
7	Flow sensor S2	"SPIR S2: ..."
8	Valve V1	"VALVE V1: ..."
9	Valve V2	"VALVE V2: ..."
10	Valve V3	"VALVE V3:. .."
11	PEEP valve V6	"VALVE PV: ..."
12	Battery	"ACCU: ..."
13	Display	"DISPLAY: ..."
14	EEPROM	"EEPROM: ..."
15	Metering block	"EJECTOR: ..."
16	Turn knob	"ROTARY: ..."
17	Communication IrDA/RS232	"IRDA: ..."
18	Real-time clock/battery RTC	"RTC: ..."
19	Voltage supply	"SUPPLY: ..."
20	Calibration	"CALIB: ..."
21	Configuration	"CONFIG: ..."

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1 Technical faults (details)

1.1 Fault group: Front panel (1)

The texts displayed in the following table are non-critical technical faults. They are displayed just like normal alarms during ventilation. These texts are also entered in the log and can be uniquely identified by the fault number.

Text	No.	Description	Remedy
"FRONT: Button VALUES jammed"	1	Key "Values" sticking	If the fault occurs continually replace the front panel.
"FRONT: Button GRAPHICS jammed"	2	Key "Curves" sticking	
"FRONT: Button PARAMETER jammed"	3	Key "Setting" sticking	
"FRONT: Button WARNINGS jammed"	4	Key "Alarms"sticking	
"FRONT: Button IPPV jammed"	5	Key "IPPV" sticking	
"FRONT: Button SIMV jammed"	6	Key "SIMV" sticking	
"FRONT: Button CPAP jammed"	7	Key "CPAP"sticking	
"FRONT: Button BIPAP jammed"	8	Key "BIPAP" sticking	
"FRONT: Button O2-INHAL jammed"	9	Key "O2.Inhalat." sticking	
"FRONT: Button SILENCE jammed"	10	Key "Silence" sticking	
"FRONT: Button RESET jammed"	11	Key "Alarm Reset" sticking	
"FRONT: Button INSP-HOLD jammed"	12	Key "Insp. hold" sticking	
"FRONT: Button ON&OFF jammed"	13	Key "OnOff" sticking	

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1.2 Fault group: Charging circuit PCB (2)

The first two texts displayed in the following table are non-critical technical faults. They are displayed just like normal alarms during ventilation. These texts are also entered in the log and can be uniquely identified by the fault number.

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Text	No.	Description	Remedy
"CHARGER: No communication"	14	No communication possible with charging circuit	-
"CHARGER: Out of work"	15	Charging circuit signals INOP	-
"CHARGER: No command response"	96	Programming error	Replace charging circuit PCB
"CHARGER: Wrong device code"	97	Device coding error	Replace charging circuit PCB
"CHARGER: Read access failed"	98	Read error	Replace charging circuit PCB
"CHARGER: Write access failed"	99	Write error	Replace charging circuit PCB
"CHARGER: Write access delay"	100	Programming error	Replace charging circuit PCB
"CHARGER: CRC old EEPROM data"	101	Old content of EEPROM is deleted	Replace charging circuit PCB
"CHARGER: Erase operation failed"	102	Deletion error	Replace charging circuit PCB
"CHARGER: CRC new FLASH code"	103	Checksum error	Replace charging circuit PCB
"CHARGER: CRC new EEPROM data"	104	Checksum error	Replace charging circuit PCB
"CHARGER: Unknown state"	105	Status unknown	Replace charging circuit PCB

1.3 Fault group: Control PCB (3)

Text	No.	Description	Remedy
"MAINBOARD: ADC overrun error"	16	AD converter error	Replace control PCB
"MAINBOARD: Wrong ADC channel"	17	AD converter error	Replace control PCB
"MAINBOARD: Flash error"	18	FLASH-EPROM error	Replace control PCB
"MAINBOARD: Flash error"	19	FLASH-EPROM error	Replace control PCB
"MAINBOARD: XRAM error"	20	RAM error	Replace control PCB
"MAINBOARD: IRAM error"	21	RAM error	Replace control PCB
"MAINBOARD: Flash test invalid"	22	FLASH-EPROM error	Replace control PCB
"MAINBOARD: LSpeaker unplugged"	23	Loudspeaker not measured (non-critical fault)	-
"MAINBOARD: SW-Watchdog error"	24	Software watchdog error	Replace control PCB
"MAINBOARD: HW-Watchdog error"	25	Hardware watchdog error	Replace control PCB
"MAINBOARD: Valve overvoltage"	90	Error in surge protector cut-out circuit for valve voltages	Replace control PCB
"MAINBOARD: HW-Watchdog error"	91	Hardware watchdog error	Replace control PCB
"MAINBOARD: CRC charger code"	94	Software error (Flash-EPROM)	Install new software Replace control PCB

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Text	No.	Description	Remedy
"MAINBOARD: CRC charger data"	95	Software error (EEPROM)	Re-initialize EEPROM (ESM Test 030) Install new software Replace EEPROM Replace control PCB
"MAINBOARD: V1 control failed"	106	Open circuit in line to valve or error in surge protector cut-out circuit	Gauge line to valve Replace control PCB
"MAINBOARD: V2 control failed"	107	Open circuit in line to valve or error in surge protector cut-out circuit	Gauge line to valve Replace control PCB
"MAINBOARD: V3 control failed"	108	Open circuit in line to valve or error in surge protector cut-out circuit	Gauge line to valve Replace control PCB

1.4 Fault group: Potentiometer array (4)

Text	No.	Description	Remedy
"POTI: VT unplugged"	26	Connection to VT potentiometer cut	Replace cable harness or potentiometer

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Text	No.	Description	Remedy
"POTI: FREQ unplugged"	27	Connection to frequency potentiometer cut	Replace cable harness or potentiometer
"POTI: PMAX unplugged"	28	Connection to Pmax potentiometer cut	Replace cable harness or potentiometer
"POTI: O2 unplugged"	29	Connection to frequency O2 potentiometer cut	Replace cable harness or potentiometer

1.5 Fault group: Sensor PCB (5)

Text	No.	Description	Remedy
"SENSOR: S3 out of range"	30	Sensor voltage outside possible range	Replace sensor PCB
"SENSOR: S6 out of range"	31	Sensor voltage outside possible range	Replace sensor PCB
"SENSOR: S7 out of range"	32	Sensor voltage outside possible range (non-critical fault)	-
"SENSOR: S9 out of range"	33	Sensor voltage outside possible range (non-critical fault)	-
"SENSOR: S4 calibration error"	34	Sensor voltage outside possible range	Calibrate sensor (see Service mode). Replace sensor PCB as necessary
"SENSOR: S5 calibration error"	35	Sensor voltage (Paw) outside possible range	Check automatic zeroing (ESM Test 024). Replace sensor PCB as necessary
"SENSOR: S7 calibration error"	36	Sensor voltage outside possible range	Calibrate sensor (ESM Test 031). Replace sensor PCB as necessary

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Text	No.	Description	Remedy
"SENSOR: S9 calibration error"	37	Sensor voltage outside possible range	Calibrate sensor (ESM Test 031). Replace sensor PCB as necessary
"SENSOR: S3 pressure too high"	38	Sensor measuring excessive pressure	Check pressure supply (2.7 to 6 bar) Check pressure downstream of pressure reducer (ESM Test 033) Replace sensor PCB as necessary
"SENSOR: S4_S5 divergence"	39	The measured values of sensors S4 and S5 differ too much (non-critical fault)	-
"SENSOR: S7_S9 divergence"	40	The measured values of sensors S7 and S9 differ too much (non-critical fault)	-
"SENSOR: VSENS out of range"	41	The supply voltage VSENS is outside the tolerance	Replace sensor PCB
"SENSOR: TEMP out of range"	42	Temperature of pneumatics outside permissible range	Check ambient temperature Replace sensor PCB as necessary

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1.6 Fault group: Flow sensor S1 (6)

Text	No.	Description	Remedy
"SPIR S1: DAC out of range"	43	Measuring range of AD converter outside permissible range	Calibrate flow sensors (ESM Test 035) Replace flow sensor S1
"SPIR S1: Timeout calibration"	44	Timeout during calibration	Calibrate flow sensors (ESM Test 035) Replace flow sensor S1
"SPIR S1: Measure wire"	45	The measuring wire of flow sensor S1 is broken	Replace flow sensor S1
"SPIR S1: Compensation wire"	46	The compensation wire of flow sensor S1 is broken	Replace flow sensor S1
"SPIR S1: Unplugged"	47	Flow sensor S1 not connected	Check plug-in contacts and connection Replace flow sensor S1 as necessary

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1.7 Fault group: Flow sensor S2 (7)

Text	No.	Description	Remedy
"SPIR S2: DAC out of range"	48	Measuring range of AD converter outside permissible range	Calibrate flow sensors (ESM Test 035) Replace flow sensor S2
"SPIR S2: Timeout calibration"	49	Timeout during calibration	Calibrate flow sensors (ESM Test 035) Replace flow sensor S2
"SPIR S2: Measure wire"	50	The measuring wire of flow sensor S2 is broken	Replace flow sensor S2
"SPIR S2: Compensation wire"	51	The compensation wire of flow sensor S2 is broken	Replace flow sensor S2
"SPIR S2: Unplugged"	52	Flow sensor S2 not connected	Check plug-in contacts and connection Replace flow sensor S2 as necessary

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1.8 Fault group: Valve V1 (8)

Text	No.	Description	Remedy
"VALVE V1: Calibration error"	53	V1 outside specifications during calibration	Replace V1
"VALVE V1: No flow measured"	54	V1 delivers no flow in unit test	Replace V1

1.9 Fault group: Valve V2 (9)

Text	No.	Description	Remedy
"VALVE V2: Calibration error"	55	V2 outside specifications during calibration	Replace V2
"VALVE V2: No flow measured"	56	V2 delivers no flow in unit test	Replace V2

1.10 Fault group: Valve V3 (10)

Text	No.	Description	Remedy
"VALVE V3: Calibration error"	57	V3 outside specifications during calibration	Replace V3
"VALVE V3: No flow measured"	58	V3 delivers no flow in unit test	Replace V3

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1.11 Fault group: Valve PV (11)

Text	No.	Description	Remedy
"VALVE PV: Calibration error"	59	PEEP valve could not be calibrated	Replace PEEP valve

1.12 Fault group: Battery (12)

Text	No.	Description	Remedy
"Accu: Not chargable"	60	The internal replaceable battery cannot be charged	The temperature is too high or the battery is faulty

1.13 Fault group: Display (13)

Text	No.	Description	Remedy
"DISPLAY: Refresh error"	61	The screen content cannot be refreshed in full	Replace display unit
"DISPLAY: Communication error"	62	Communication with display unit interrupted	Replace display unit

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1.14 Fault group: EEPROM (14)

Text	No.	Description	Remedy
"EEPROM: Checksum error"	63	Error forming EEPROM checksum	Replace control PCB
"EEPROM: Read error"	64	Error reading EEPROM	Replace control PCB
"EEPROM: Communication error"	65	Communication with EEPROM interrupted	Replace control PCB

1.15 Fault group: Metering block (15)

Text	No.	Description	Remedy
"EJECTOR: Deviation to high"	66	Loop control not OK (non-critical fault)	-

1.16 Fault group: Turn knob (16)

Text	No.	Description	Remedy
"ROTARY: Button jammed"	67	Turn knob permanently pressed or sticking (non-critical fault)	If the fault recurs continually, replace turn knob

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1.17 Fault group: Communication IrDA/RS232 (17)

Text	No.	Description	Remedy
"IRDA: Parity error"	68	Transmission fault	Repeat transmission Replace control PCB
"IRDA: Framing error"	69	Transmission fault	Repeat transmission Replace control PCB
"IRDA: Overrun error"	70	Transmission fault	Repeat transmission Replace control PCB
"IRDA: Rx buffer overflow"	71	Transmission fault	Repeat transmission Replace control PCB
"IRDA: Tx buffer overflow"	72	Transmission fault	Repeat transmission Replace control PCB
"IRDA: Configuration error"	73	Incorrect configuration	Check configuration Repeat transmission Replace control PCB

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1.18 Fault group: Real-time clock/battery RTC (18)

Text	No.	Description	Remedy
"RTC: RAM magic error"	74	Data loss in RAM of real-time clock (non-critical fault)	Re-initialize real-time clock (ESM Test 030)
"RTC: Checksum error"	75	Wrong checksum	Re-initialize real-time clock (ESM Test 030)
"RTC: Logbook entry error"	76	Wrong checksum	Re-initialize real-time clock (ESM Test 030) Replace control PCB as necessary
"RTC: Logbook entry error"	77	Wrong checksum (entry)	Re-initialize real-time clock (ESM Test 030) Replace control PCB as necessary
"RTC: Date or time error"	78	The time or date is being influenced and is not running correctly	Replace control PCB as necessary
"RTC: Wrong date or time"	79	Time or date wrong	Reset date and time (CSM Test 003) Replace battery of real-time clock Replace control PCB as necessary

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1.19 Fault group: Voltage supply (19)

1.19.1 General introduction

The voltage supply VBAT is the voltage which goes directly from the charging circuit PCB to the control PCB. The supply voltage VINT is the switched VBAT (VINT present = unit switched on). The remaining supply voltages mentioned here are obtained on the control PCB from this voltage (VINT).

Text	No.	Description	Remedy
"SUPPLY: VINT out of range"	80	Supply voltage VINT outside tolerancce (8.6 V to 19.5 V)	Check voltage VINT in service mode (ESM Test 027) Check battery voltage (VBAT) in service mode (ESM Test 021) Measure voltage VINT and VBAT on control PCB Replace charging circuit PCB or control PCB as necessary.
"SUPPLY: VNEG out of range"	81	Supply voltage VNEG outside tolerance	Check voltage VNEG in service mode (ESM Test 027) Check voltage VINT in service mode (ESM Test 027) Replace control PCB as necessary

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Text	No.	Description	Remedy
"SUPPLY: VVENT out of range"	82	Supply voltage VVENT outside tolerance (8.6 V to 19.5 V)	Check voltage VVENT in service mode (ESM Test 027) Check voltage VINT in service mode (ESM Test 027) Replace control PCB as necessary
"SUPPLY: VDA out of range"	83	Supply voltage VDA outside tolerance	Spannung VDA im Service-Mode kontrollieren (ESM Test 027) Spannung VINT im Service-Mode kontrollieren (ESM Test 027) Replace control PCB as necessary
"SUPPLY: VDISP out of range"	84	Supply voltage VDISP outside tolerance	Check voltage VDISP in service mode (ESM Test 027) Check voltage VINT in service mode (ESM Test 027) Replace control PCB as necessary

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Text	No.	Description	Remedy
"SUPPLY: VLOG out of range"	85	Supply voltage VLOG outside tolerance	Check voltage VLOG in service mode (ESM Test 027) Check voltage VINT in service mode (ESM Test 027) Replace control PCB as necessary

1.20 Fault group: Calibration (20)

Text	No.	Description	Remedy
"CALIB: Device not calibrated"	86	The valves and /or the sensors are not calibrated (non-critical fault)	Calibrate valves and /or sensors (see ESM)
"CALIB: Autozero function"	93	Error in automatic zeroing	Check zeroing in service mode (ESM Test 024) Replace valves Replace control PCB

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1.21 Fault group: Configuration (21)

Text	No.	Description	Remedy
"CONFIG: No device ID"	87	Invalid device ID	Notify head office in Lübeck
"CONFIG: Board incompatible"	88	Invalid hardware status of sensor PCB	Replace sensor PCB
"CONFIG: Board incompatible"	89	Invalid hardware status of control PCB	Replace control PCB
CONFIG: Download aborted	92	The download was aborted	Run new download Run bootstrap download

1.22 Data in this documentation

Unit: Oxylog 3000

Section: Repair Instructions

Version: Version 1.0

Status: Released

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Section 7

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1 Replacing the internal battery

1. Slacken the screw Fig. 1/1 of the battery compartment cover anti-clockwise until the cover can be opened.
2. Fold the cover Fig. 1/2 down.
3. Pull the internal battery Fig. 1/3 forward by its tab and withdraw it.

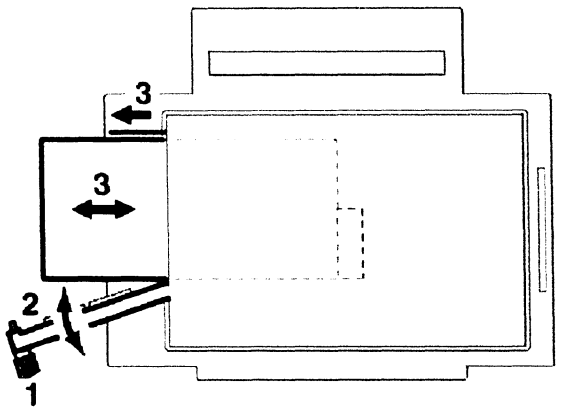

Fig. 1 Removing the internal battery

4. Press the button on the new internal battery and check the charge.

The LEDs on the internal battery indicate the charge condition in percent.

5. Charge the internal battery as necessary.

The internal battery can be charged by the battery charger station or by the external power supply in the Oxylog 3000.

1. Fit the internal battery.
2. Switch on the Oxylog 3000 and check the battery capacity indicated on the display.

1 Replacing the filter element

1. Switch off the unit.
2. Remove screws Fig. 1.

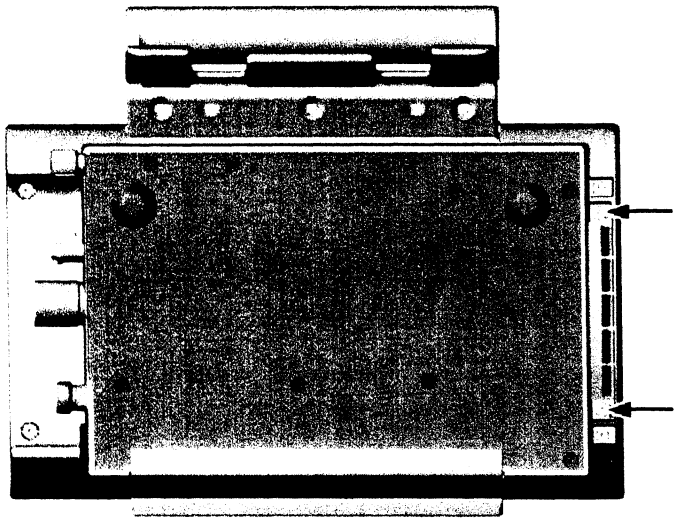

Fig. 1 Removing the filter element

Note fitting position of filter element.

3. Remove the filter element.
4. Install the new filter element.
5. Carry out a unit test.
6. Place fully functional unit at the user's/owner's disposal.

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1 Replacing the battery for the real-time clock (RTC)

The battery of the real-time clock is located directly on the real-time clock. To replace the battery:

1. Open the unit.

⚠ **Pay attention to the polarity. If the battery polarity is reversed the RTC will be destroyed. Note fitting position of battery.**

2. Remove the battery Fig. 1/Fig. 2 from the real-time clock.

ℹ Batteries represent special waste. Dispose of the batteries in accordance with local waste disposal regulations.

3. Fit the new battery into the real-time clock.
4. Assemble the unit complete.
5. Call up Test 003 in the CSM and set the time and date (see Instructions for Use).
6. Carry out a unit test and check the time and date.
7. Place fully functional unit at the user's/owner's disposal.

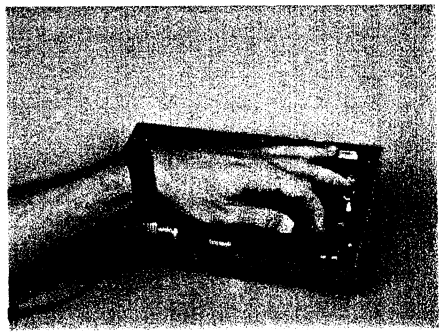

Fig. 1 Removing the battery

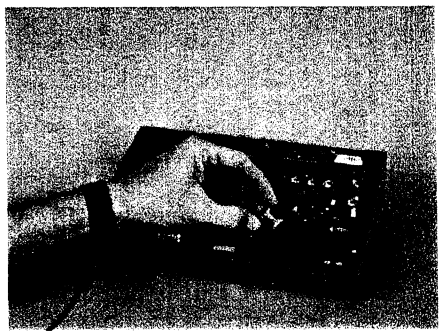

Fig. 2 Real-time clock battery

1 Replacing and calibrating the flow sensors

1.1 Replacing the flow sensors

The flow sensors in the Oxylog 3000 are specific, selected flow sensors. Normal flow sensors would impair the functioning of the unit. Use only the flow sensors specified in the replacement articles list.

1. Open the unit.
2. Remove tube Fig. 1/1.

The socket of the pressure sensor S3 may snap. Remove the tube 2 only from the connector block.

3. Remove tube Fig. 1/2 from connector block.

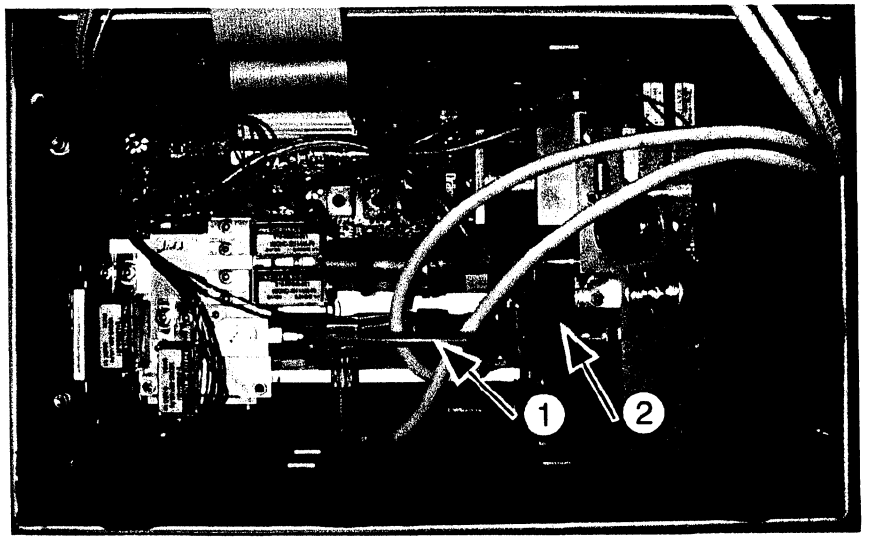

Fig. 1 Removing tubes

4. Remove the metering block fixing screws Fig. 2/3.

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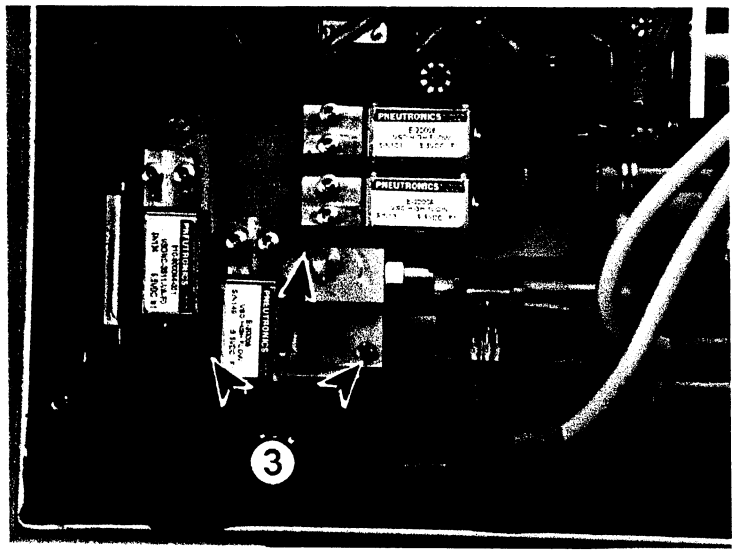

Fig. 2 Metering block fixing screws

⚠ **The flow sensors have a specific fitting position. Note the fitting position, direction and horizontal orientation of the flow sensors.**

⚠ **There are filters in the flow sensor connections. The filters must sit correctly after being installed, otherwise the flow sensor may be damaged. Note the fitting positions of the filters.**

5. Remove the metering block together with the flow sensors.
6. Remove the cable ties from the plastic bracket.
7. Remove the flow sensors from the plastic brackets.
8. Install the new flow sensors.
9. Check the seating of the filters and correct them as necessary.
10. Replace the cable ties.
11. Assemble the unit complete.
12. Calibrate the flow sensors (1.2 Calibrating the flow sensors).

1.2 Calibrating the flow sensors

Note the following points before calibrating the flow sensors:

⚠ **If the pressure reducer and the flow sensors are replaced at the same time, the pressure reducer must be set first before the flow sensors are calibrated.**

⚠ **If the ambient pressure sensors have not been calibrated for a long time (more than one year) they must be calibrated before the flow sensors are calibrated.**

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The gas type shown on the display must be identical to the connected gas type. The gas type can be set in service mode.

When the flow sensors are being calibrated there must be no flow in the system, the connection for the ventilation tube must be open and the temperature in the Oxylog 3000 must not exceed 50 °C.

1. Connect the compressed gas supply to the unit.
2. Call up ESM Test 035 and calibrate the flow sensors.
3. Check unit according to PMS Procedure.
4. Place fully functional unit at the user's/owner's disposal.

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1 Replacing and adjusting the pressure reducer

1.1 Replacing the pressure reducer

1. Open the unit.
2. Remove the two diagonally opposite fixing screws Fig. 1/1 of the pressure reducer.

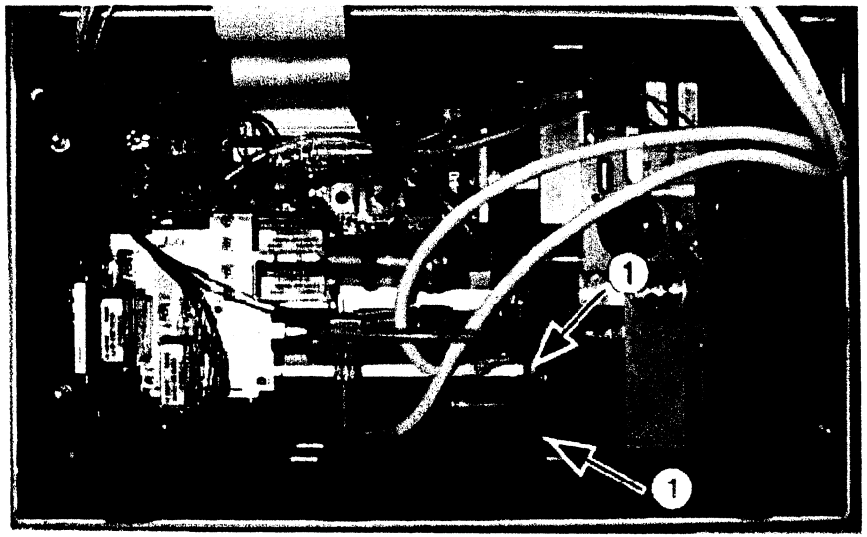

Fig. 1 Pressure reducer fixing screws

3. Remove the pressure reducer.
4. Close the new pressure reducer (push cap aside and turn fully anti-clockwise).
5. Install the new pressure reducer.
6. Adjust the pressure reducer (1.2 Adjusting the pressure reducer).

1.2 Adjusting the pressure reducer

1. Remove tube Fig. 2/1.

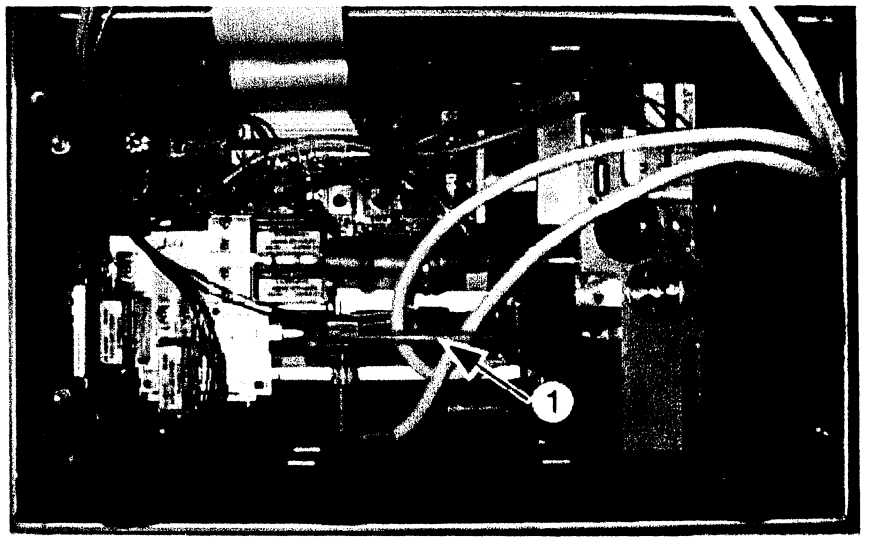

Fig. 2 Connector block tube

2. Connect a tube with T-piece and pressure gauge Fig. 3 in place of the tubeFig. 2/1.
3. Connect connectors from pneumatic system to control PCB.

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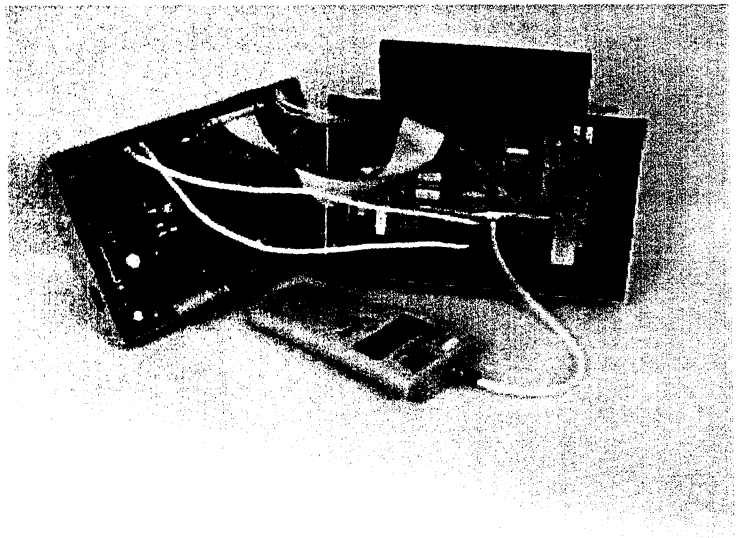

Fig. 3 Setting the pressure reducer test set-up

4. Connect the compressed gas supply.

To adjust the pressure reducer the socket for the ventilation tube must be open.

5. Call up ESM Test 033.
6. In this test start the flow of 40 L/min (the internal flow sensor regulates this flow independently of the supply pressure).
7. Unlock the pressure reducer (push cap aside).
8. Set pressure reducer to 3 bar +/-0.05 bar.
9. Lock the pressure reducer.
10. Assemble the unit complete.
11. Carry out a unit test.
12. Place fully functional unit at the user's/owner's disposal.

Section 8

Dräger
MEDICAL

PMS

Oxylog 3000

Notes on field of application:

Tests marked with the symbol "(√)" are listed in the Inspection Report. The test results are to be documented in the Inspection Report.

This PMS applies to software version 1.n.

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1 Unit configuration

1.1 Inspection price

The inspection price includes testing of the Oxylog 3000.

Special agreements with the customer shall be taken into consideration.

1.2 Serial number (SN)

(√) **1.2.1 Oxylog 3000** [_____]

The serial number is located on the rating plate.

1.3 Software

(√) **1.3.1 Software version** [_____]

The software version is displayed on-screen immediately after power-up.

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2 Maintenance parts

Fitting of Maintenance parts is classified as repair and is therefore not included in the inspection price.

2.1 Maintenance intervals

The following list indicates the maintenance parts and the associated maintenance intervals, in months.

Table 1: Maintenance parts

Maintenance interval in months		Order number	Quantity	Designation
24	72			
X		2M86341	1	Filter element (Filterflies)
X		2M86349	2	Spirolog sensor
X		2M86732	1	Replaceable battery (nickel-metal-hydride) or
		2M86733		Replaceable battery, lithium ion
	X	1851918	1	Real-time clock battery
	X	2M86361	1	Pressure reducer

$400

$540

(√) **2.1.1 Maintenance interval** **[_____ mon.]**

Record completion of scheduled maintenance. Entry in months.

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3 Electrical safety

3.1 Oxylog 3000 - not applicable -

3.2 AC/DC power pack

The AC/DC power pack is categorized as protection class I (safety insulated). Measure to VDE 0751 or IEC 601.

3.2.1 Equivalent device leakage current test

The subsequent measurements may exceed the initial measured value by max. 50% and must at the same time be ≤ 500 µA.

1. Connect output of AC/DC power pack to Oxylog 3000.

(√) **3.2.1.1 Initial measured value** **[_____µA]**

(√) **3.2.1.2 Current value** **[_____µA]**

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4 Function and condition test

(√) 4.1 Accompanying documentation

Instructions for Use available according to operator.

[OK]

(√) 4.2 Visual check

The condition of the Oxylog 3000 is assessed by a visual check.

4.2.1 Housing

The housing is not contaminated by dirt or damaged. The labels are clearly legible.

[OK]

4.2.2 Compressed gas connection

The compressed gas connection is not damaged.

[OK]

4.2.3 Ventilation tube and ventilation valve

The ventilation tube and ventilation valve are not hardened or damaged.

[OK]

4.2.4 Electrical power supply

The connecting cables are not porous, severely kinked or damaged.

[OK]

4.2.5 Carrier system and accessories

The carrier system and accessories are not damaged.

[OK]

(√) 4.3 Unit test

1. Connect unit to power and to O2 compressed gas supply.
2. Connect ventilation tube and ventilation valve to flow sensor and flow-meter tubes.
3. Connect test specimens (breathing bag and catheter socket) to flow sensor with elbow adapter.
4. Switch on the unit and immediately press and hold down the knob until the menu for selection of the unit test appears.
5. Select and activate the unit test.
6. Follow the on-screen instructions.

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The unit test runs without error.

[OK]

In the event of an error a technical fault is signalled and entered in the log. Rectify errors and repeat the unit test.

(√) 4.4 Buttons and potentiometer

1. Set the unit to Customer Service mode (see also "Appendices").
2. Activate the "Test buttons and potentiometer" test mode.
3. Test all buttons on the unit.

When a button is pressed a corresponding "X" appears on-screen. If the button has an integral LED, the LED lights up while the button is being pressed. If there is no LED, the yellow warning LED is lit.

[OK]

4. Set the potentiometer to various settings and compare them against the values displayed on-screen.

The pre-set and displayed values are identical.

[OK]

i If the values differ and there is no error, the potentiometer buttons can be released and re-adjusted.

(√) 4.5 Loudspeaker, buzzer, LEDs and display

1. Set the unit to Customer Service mode (see also "Appendices").
2. Activate the "Test loudspeaker, buzzer, LEDS and display" test step.
3. Run the complete test.

The tests of the loudspeaker, the buzzer, the LEDs and the display were successful.

[OK]

(√) 4.6 Safety valve

1. Connect unit to power and to O2 compressed gas supply.
2. Connect pressure gauge to ventilation tube connector (the connection must be sealed tight).
3. Call up test step 022 in Extended Service mode (see also "Appendices"). Generate a flow of 100 L/min and actuate the PEEP valve at 130 mA.

The pressure may be maximum 90 mbar.

[OK]

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If the pressure is greater than 90 mbar, re-adjust the safety valve if there are no errors.

4.7 Voltage supply

1. Connect unit to power and to O2 compressed gas supply.
2. Connect ventilation tube and ventilation valve to flow sensor and flow-meter tubes.
3. Connect test thorax, elbow adapter and flow sensor.

(√) 4.7.1 External power supply

The external power LED lights up green.

[OK]

The charge indicator LED of the internal replaceable battery lights up in the following colours:

- Yellow: when the replaceable battery is charging
- Green: when the battery is fully charged
- Red: when no functional battery is inserted or the battery cannot be charged, such as because the unit is being used outside the temperature range of 0 to 35 °C.

[OK]

(√) 4.7.2 Internal replaceable battery

1. Switch on unit.
2. Set ventilation mode IPPV.
3. Remove internal replaceable battery.
   - The unit continues ventilating.
   - The display shows the message "No battery".
   - The charge indicator LED is lit red.
   - An acoustic alarm sounds.

[OK]

4. Refit the internal replaceable battery.
   - The charge indicator LED is lit green.
   - The acoustic alarm is deactivated.
5. Press the "Alarm Reset" button.

The "No battery" message is no longer displayed.

[OK]

6. Remove external power supply.

The unit continues ventilating.

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- The external power LED is unlit.
- The internal replaceable battery charge indicator LED is unlit.
- An acoustic alarm sounds.
- The display shows the message "Battery operating".

[OK]

7. Press the "Alarm Reset" button.

The "Battery operating" message is no longer displayed.

[OK]

8. Remove internal replaceable battery.
   - Ventilation stops.
   - An acoustic alarm sounds for at least 7 seconds.

[OK]

9. Refit the internal replaceable battery.
10. Connect the external power supply.

Ventilation is resumed with the previous settings.

[OK]

(√) 4.8 Supply pressure/emergency air valve

1. Connect unit to power and to O2 compressed gas supply.
2. Connect ventilation tube and ventilation valve to flow sensor and flow-meter tubes.
3. Connect test thorax, elbow adapter and flow sensor.
4. Set ventilation mode IPPV.
5. Remove compressed gas supply.
   - An acoustic alarm sounds.
   - The display shows the message "!!!Supply pressure low".
   - The red alarm LED lights up.
   - Ventilation stops.

[OK]

6. Simulate spontaneous breathing with the test thorax.

Ventilation through the emergency air valve is possible.

[OK]

7. Connect the compressed gas supply.
   - The acoustic alarm stops.
   - The red alarm LED is no longer lit.
   - Ventilation is resumed with the previous settings.

[OK]

8. Press the "Alarm Reset" button.

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The "!!!Supply pressure low" message is no longer displayed.

[OK]

4.9 Ventilation

(√) 4.9.1 Volume-controlled ventilation

1. Connect unit to power and to O2 compressed gas supply.
2. Connect ventilation tube and ventilation valve to flow sensor and flow-meter tubes.
3. Connect test specimens (breathing bag and catheter socket) to flow sensor with elbow adapter.
4. Make the following settings:
   - Ventilation mode = IPPV
   - Frequency = 10 1/min
   - Alarm limit Pmax = 60 mbar
   - PEEP = 5 mbar
   - O2 = 60 Vol.%
   - I/E = 1:1
   - TPlat = 50%
   - Trigger = off
   - VT = 200 mL
5. Press the "Values" button to select the measured values MV and VTE.

The displayed MV is in the range 1.3 L/min to 2.3 L/min.

[OK]

6. Set VT to 500 mL.

The displayed MV is in the range 3.7 L/min to 5.3 L/min.

[OK]

7. Set VT to 1000 mL.

The displayed MV is in the range 8 L/min to 10 L/min.

[OK]

(√) 4.9.2 Pressure-controlled ventilation

1. Remove test specimens and connect test thorax in their place.
2. Make the following settings:
   - Ventilation mode = BIPAP (option)
   - Frequency = 6 1/min
   - Alarm limit Pmax = 60 mbar
   - PEEP = 5 mbar
   - Pinsp = 25 mbar
   - Tinsp = 5 s

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- O2 = 60 Vol.%
- NIV = off
- Trigger = 15 L/min
- Ramp = standard (middle curve)

Wait a few breaths for the values to stabilize.

The displayed PEEP value is in the range 3 mbar to 7 mbar.

[OK]

Ppeak is in the range 23 mbar to 27 mbar.

[OK]

(√) 4.9.3 Trigger function

1. Make the following settings:
   - Ventilation mode = SIMV
   - Frequency = 5 1/min
   - PEEP = 10 mbar
   - Tinsp = 1 s
   - VT = 500 mL
   - Alarm limit Pmax = 60 mbar
   - O2 = 60 Vol.%
   - Flow trigger = 3 L/min
   - Flow ramp = not applicable, or standard

The test thorax inflates to a PEEP pressure of 10 mbar.

[OK]

No self-triggering occurs.

[OK]

The message "O2 setting not possible" may appear. The message can be ignored.

2. Trigger using the test thorax.

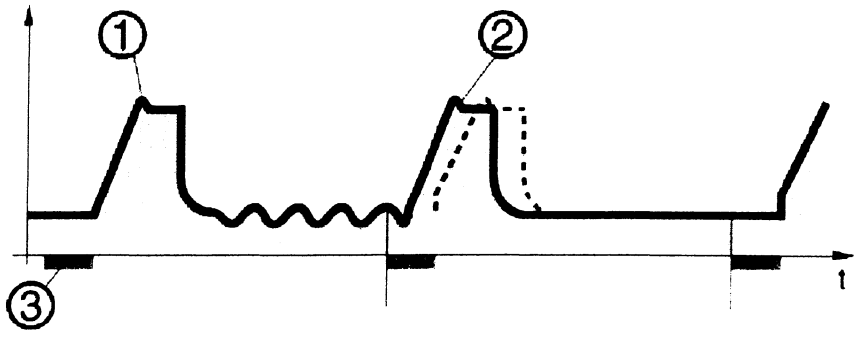

Fig. 1 Trigger window, for legend see Table 2:

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Table 2: Legend to Fig. 1

Number	Designation
1	Unsynchronized mandatory ventilation stroke
2	Synchronized mandatory ventilation stroke
3	Trigger window

The unit triggers and activates a ventilation stroke. At the same moment a "star" appears on the top line of the display.

[OK]

(√) 4.10 Unit handover

Place fully functional unit at the user's/owner's disposal.

[OK]

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5 Test equipment

(√) 5.1 Test equipment subject to calibration

Designation	Order number	Features/Note
Digital pressure gauge	7910722	Measuring range to 1000 mbar

5.2 Test equipment not subject to mandatory calibration

Designation	Order number	Features/Note
Test lung (test thorax)	7911140	-
Test lung, comprising the following components:		
Breathing bag	8403201	2 litre breathing bag to simulate lung compliance.
Catheter socket diameter 7 mm	M29307	To simulate the airway impedance

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6 Appendices

6.1 Access to Customer Service mode (CSM)

To access Customer Service mode (see also Fig. 2):

1. Turn the adjuster 1 fully clockwise.
2. Switch on the unit by the button 3 and at the same time press and hold down the buttons 2 until Customer Service mode appears.

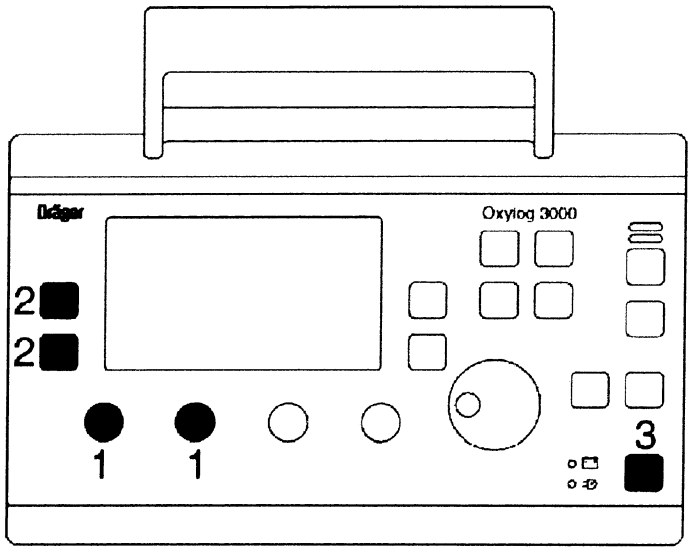

Fig. 2 Activating Service mode

Now the appropriate test can be selected and activated. To quit Service mode switch off the unit. The values set in Customer Service mode are retained and reactivated every time ventilation is started following power-up.

6.2 Access to Extended Service mode (ESM)

To access Extended Service mode:

1. Start Customer Service mode.
2. Select test 222.
3. Press turn knob until "Extended Service Mode" appears.
4. Press turn knob again (to confirm message).

Now the appropriate test can be selected and activated.

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